A PROSPECTIVE STUDY OF EMERGENCY LAPAROTOMIES AMONG PATIENTS ATTENDING CHENGALPATTU MEDICAL COLLEGE

Dissertation submitted to

THE TAMILNADU Dr. M. G. R. MEDICAL UNIVERSITY

In partial fulfillment of the regulations for the award of the degree of

M. S. GENERAL SURGERY (BRANCH I)

CHENGALPATTU MEDICAL COLLEGE

THE TAMILNADU Dr. M. G. R. MEDICAL UNIVERSITY

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ABSTRACT;

Emergency laparotomy is required for major intra-abdominal haemorrhage spontaneous or due to abdominal trauma and for infective, ischemic and obstructive condition in which gastric intestinal wall as a barrier is breached or threatened.

METHODS

A PROSPECTIVE study of emergency laparotomies among patients attending Chengalpattu Medical College with acute abdomen and to know about its complications and management in our set up was conducted from October 2011 to September 2013.

Study was conducted in to the incidence of complications among various patients and associated complication factors predisposing to such complications. Management of such risk factors could result in better prognosis and outcome in patient undergoing emergency laparotomies.

RESULTS

- Acute abdomen was more common among 31 to 40 years group
- Male is to female ratio was 4:1
- Hollow viscus perforation was the most common cause for emergency laparotomy

- Duodenal perforation was the single most common cause for emergency laparotomy
- Diverticulitis was the least common cause for emergency laparotomy
- Post-operative complication rate was 27%
- Post-operative mortality was 3%
- SSI is the most post-operative complication
- E. coli was the most common cause for SSI
- Post-operative myocardial ischemia had higher mortality
- Contaminated wound was the most common type in emergency laparotomies
- Hypoalbuminemia results in post-operative wound complications
- 20% albumin in the post-operative period resulted in early wound healing and reduced hospital stay
- Post-operative complications can be managed conservatively in 74%
- Surgical management needed only in 26% of complications

KEY WORDS

Laparotomy, duodenal perforation, blunt injury, diverticulitis , appendicitis, surgical site infection

INTRODUCTION

Emergency laparotomy is required for major intra-abdominal haemorrhage spontaneous or due to abdominal trauma and for infective, ischemic and obstructive condition in which gastric intestinal wall as a barrier is breached or threatened.

Exploratory laparotomy is carried out in conditions where the need for an operation is recognized but where a definite diagnosis can be made only until the abdomen is opened.

Emergency laparotomy is a high risk procedure which involves making an incision preferably in the midline to provide access to abdominal cavity and is associated with significant morbidity and mortality.

Term also describes procedure for which the clinical presentation, pathology anatomical site, perioperative management vary considerably and immediate intervention is warranted to save the life of the patient.

OBJECTIVES OF STUDY

A PROSPECTIVE study of emergency laparotomies among patients attending Chengalpattu Medical College with acute abdomen and to know about its complications and management in our set up.

MATERIALS AND METHODS

This prospective study was carried out in our institution over a period of 2 years from 1st October 2011 to 30th September 2013. All patients attending our institution found to have acute abdomen by clinical evaluation are included in the study.

Data's regarding name, age, inpatient number, gender, relevant history, physical status, investigations such as hemoglobin%, complete blood count TC, DC, blood sugar, urea, creatinine, electrolytes, serum proteins, Blood grouping and Rh typing, Chest radiograph, X Ray Abdomen Erect, Ultrasound abdomen and pelvis, CT Scan abdomen and pelvis] anatomical site of surgery, , type of incision used, ASA Category, diagnosis, pre-operative antibiotics, operative procedure done, wound classification, duration of surgery, length of hospital stay, post-operative complications such as were tabulated and recorded in the prescribed format. Post-operative complication given emphasis were

1. Bleeding
2. Hematoma
3. Fever
4. SSI
5. Wound dehiscence
6. Burst abdomen

7. Ileus
8. DVT
9. Sub-Diaphragmatic abscess
10. Stich abscess
11. Enterocutaneous fistula
12. Hernia
13. Intestinal Obstruction
14. Atelectasis
15. MI
16. Dementia, etc…,

Cases are selected by following Inclusion and exclusion criteria;

Inclusion criteria;

- All acute abdomen (blunt injury, peritonitis, bowel strangulation / obstruction) cases attending our institution.
- Age > 13yrs and <70yrs.
- Laparotomy which were approached by midline incision.
- Prolene 1’0 was used universally for rectus closure by continuous locking sutures.
- 2’0 Vicryl was the absorbable suture which was used for anastomosis.
- Urinary catheterization was routinely done for all cases.
- Abdominal tube drain was routinely placed one in the sub-Morrison and another in the pelvic cavity as warranted by the diagnosis.
- Prolene 3’0 used for approximation of skin by interrupted sutures.

Exclusion criteria;

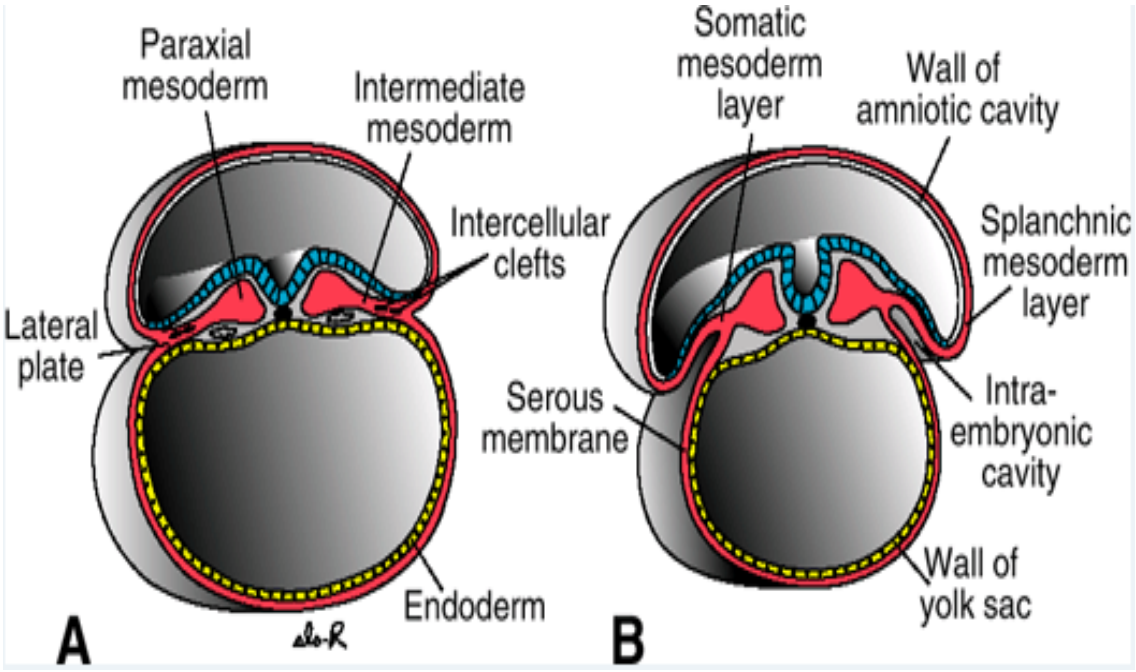
- Pediatric age <12yrs
- Pregnant women
- Lactating mothers
- Female patients with gynecological disease
- Laparotomy which were approached by other than midline incision
- Acute abdomen managed by conservative methods

REVIEW OF LITERATURE

EMBRYOLOGY

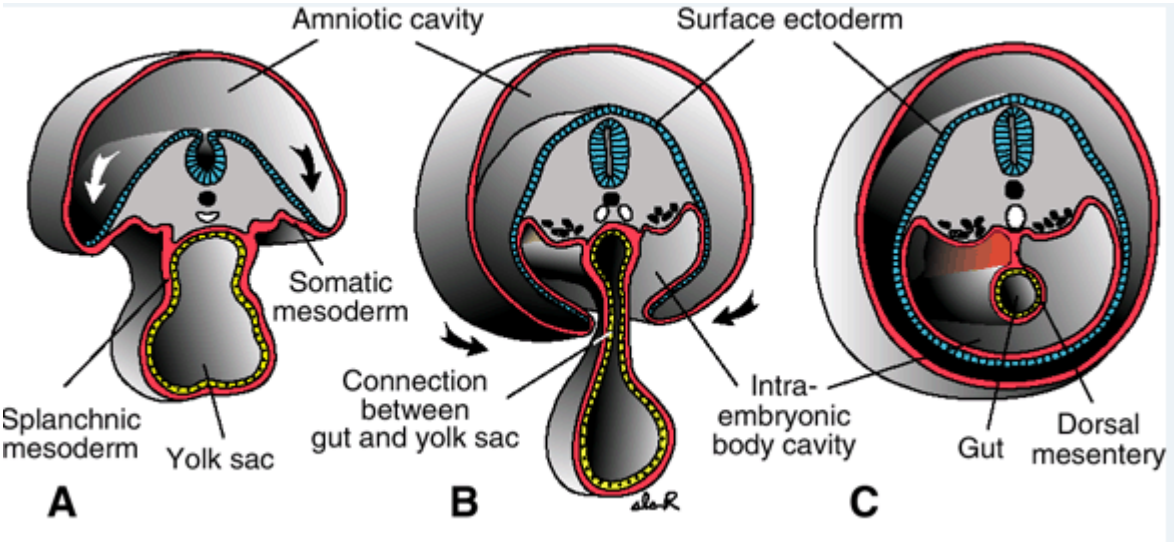
Formation of the intraembryonic cavity (body cavity).

At the end of the 3rd week, intraembryonic mesoderm on each side of the midline differentiates into a paraxial portion, an intermediate portion, and a lateral plate. When Intercellular clefts appear in the lateral mesoderm, the plates are divided into two layers:- the somatic mesoderm layer and the splanchnic mesoderm layer. The latter is continuous with mesoderm of the wall of the yolk sac. The space bordered by these layers forms the intraembryonic cavity (body cavity).



A- Transverse section in an embryo at 19 days

B- Transverse section in an embryo at 20 days



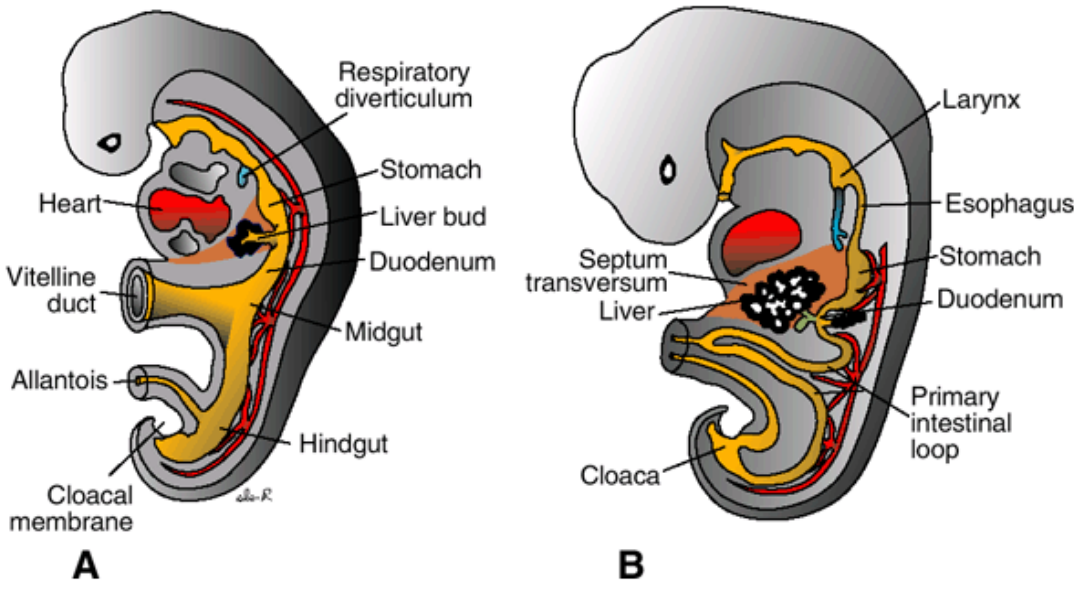
A- The intraembryonic cavity is in open communication with the extraembryonic cavity.

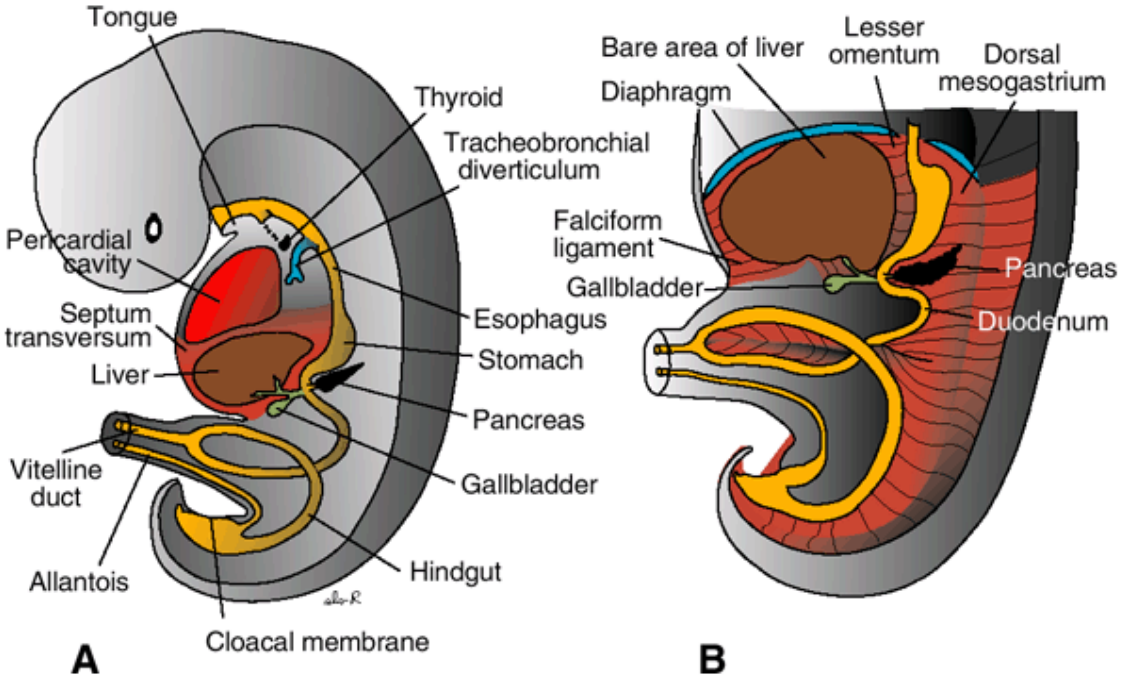
B- Intraembryonic cavity is about to lose contact with the extraembryonic cavity.

C- Splanchnic mesoderm layers are continuous with somatic layers as a double-layered membrane, the dorsal mesentery.

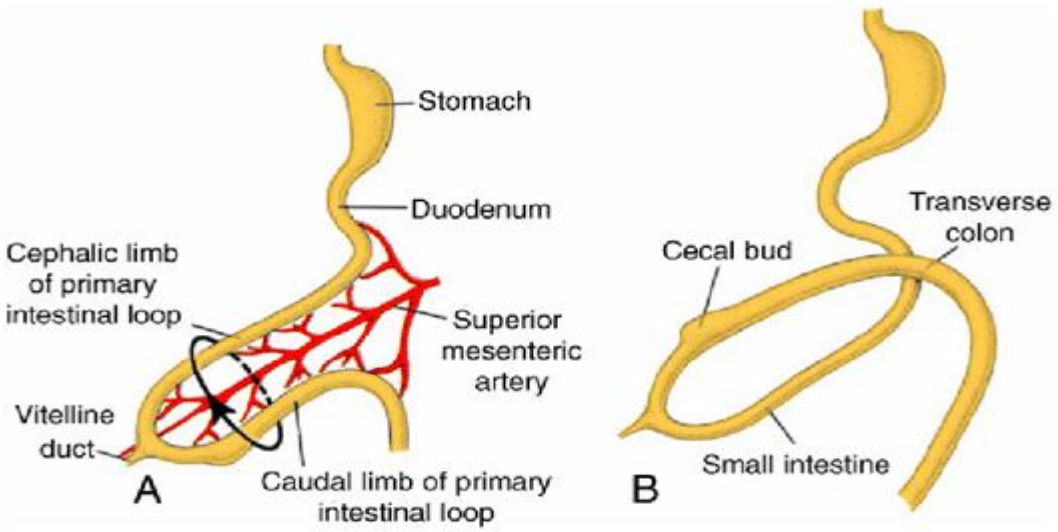
Cells of the somatic mesoderm line the intraembryonic cavity becomes mesothelial and forms the parietal layer of the serous membrane lining the outside of the peritoneal, pleural, and pericardial cavities. In a similar manner, cells of the splanchnic mesoderm form the visceral layer of the serous membrane covering the abdominal organs. Visceral and parietal layers are continuous as the dorsal mesentery which suspends the gut tube in the peritoneal cavity. Initially, the dorsal mesentery is a thick band of mesoderm running continuously from the caudal limit of the foregut to the end of the hindgut. Ventral mesentery exists only from the caudal foregut to the upper portion of the duodenum. Mesenteries are

double layers of peritoneum that provide a pathway for blood vessels, nerves, and lymphatic's to the organs.





The Foregut gives rise to the oesophagus, trachea, lung buds, stomach, and the duodenum proximal to the entrance of the bile duct. In addition, the liver, pancreas, and biliary apparatus develop as outgrowths of the endodermal epithelium of the upper part of the duodenum. The epithelial liver cords and biliary system growing out into the septum transversum differentiate into parenchyma. Hematopoietic cells, Kupffer cells, and connective tissue cells originate in mesoderm. The pancreas develops from a ventral bud and a dorsal bud that later fuse to form the definitive pancreas.



The Midgut forms the primary intestinal loop giving rise to the duodenum distal to the entrance of the bile duct, and continues up to the junction of the proximal two-thirds of the transverse colon. At its apex the primary loop remains temporarily in open connection with the yolk sac through the vitelline duct. During the sixth week, the loop grows so rapidly and it protrudes into the umbilical cord (called physiological

herniation). During the 10th week, it again returns back into the abdominal cavity. While these processes are occurring, the midgut loop rotates 270° counter clockwise to accommodate the caecum at right iliac fossa. Remnants of the vitelline duct, , malrotation, stenosis, failure of the midgut to return to the abdominal cavity and duplications of parts of the gut are common abnormalities.

The Hindgut gives rise to the region from the distal third of the transverse colon to the upper part of the anal canal, the distal part of the anal canal originates from ectoderm. The hindgut enters the posterior region of the cloaca (future anorectal region), and the allantois enters the anterior region (future urogenital region). Breakdown of the cloacal membrane covering this provides communication to the exterior for the anus and urogenital sinus.

ANATOMY OF THE ANTERIOR ABDOMINAL WALL

Anterior abdominal wall comprises of

1- Skin

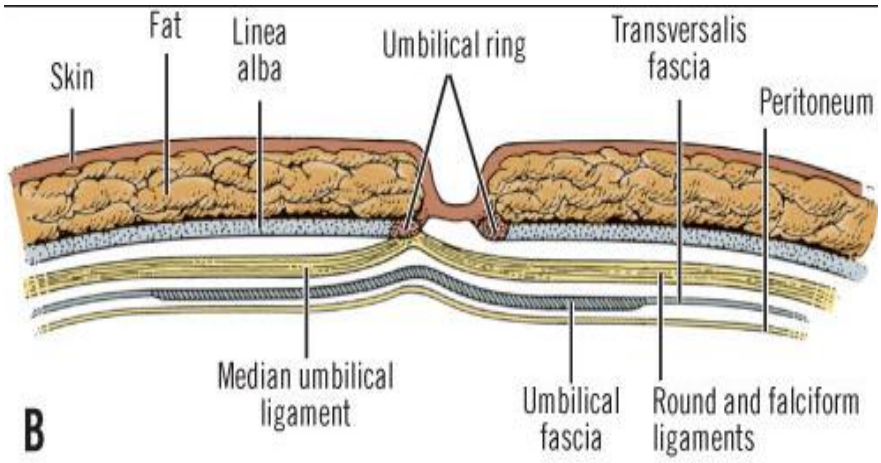
2- Soft tissue

3- Antero lateral abdominal muscles

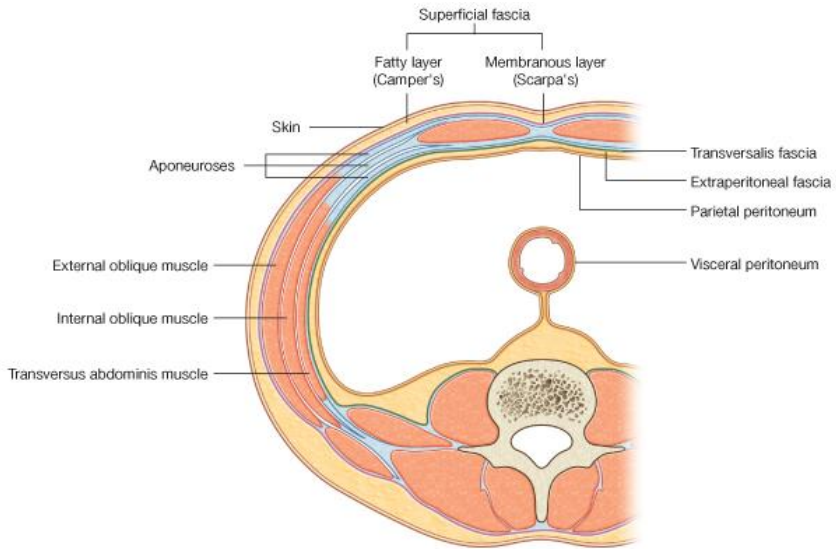
4- Lymphatic's

5- Vascular structures and

6- Segmental nerves



B. Sagittal section of abdominal wall

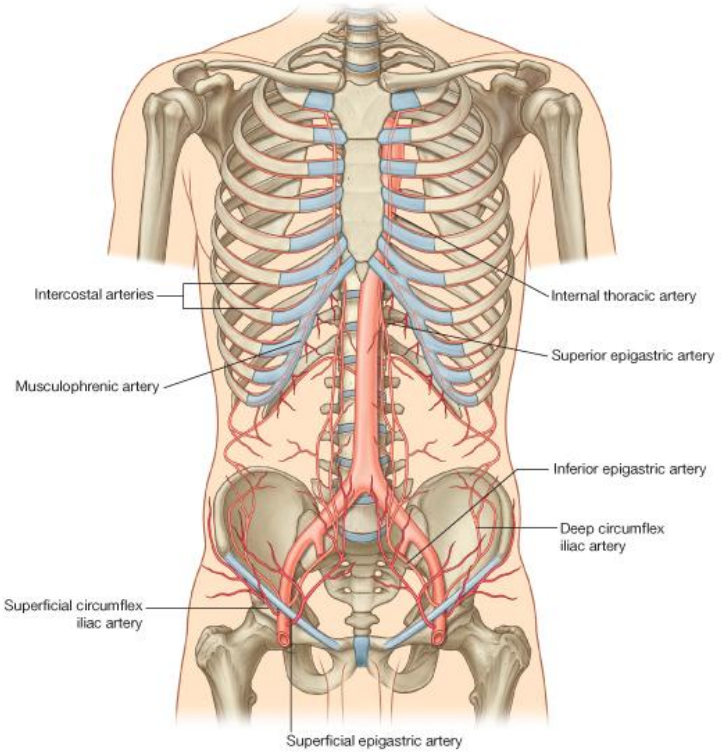


Skin and subcutaneous fat forms the outer layer, subcutaneous fat is variable in thickness and excess fat is stored here in obesity. All individuals have extension of pubic hair onto the anterior abdominal wall, although this is most pronounced in males, in whom the hair extend up to the umbilicus in a triangular pattern.

Blood supply of Anterior Abdominal wall;

Anterior abdominal wall receives its blood supply from[4]

1- The right and left superior epigastric artery
2- The right and left inferior epigastric artery
3- Paired posterior inter costal artery
4- Paired subcostal artery
5- Paired lumbar vessels



Superior epigastric artery and vein;

It is a terminal branch of internal thoracic artery descends between the costal and xiphoid slips of the diaphragm accompanied by its vein. Vessels pass anterior to the transversus abdominis and enter the rectus sheath behind the rectus abdominis and run down to anastomoses with the inferior epigastric artery at the level of umbilicus. Terminal branches perforate the anterior rectus to supply the skin.

Inferior epigastric artery and vein;

It originates from external iliac artery posterior to inguinal ligament, course along the anterior extra peritoneal tissue and extends to pierce the transversalis fascia and the posterior rectus sheath and runs between the rectus abdominis and posterior lamina of rectus sheath. It anastomosis with superior epigastric and lower six intercostal arteries. The vas deferens round ligament are related to inferior epigastric artery. The branches of inferior epigastric artery are

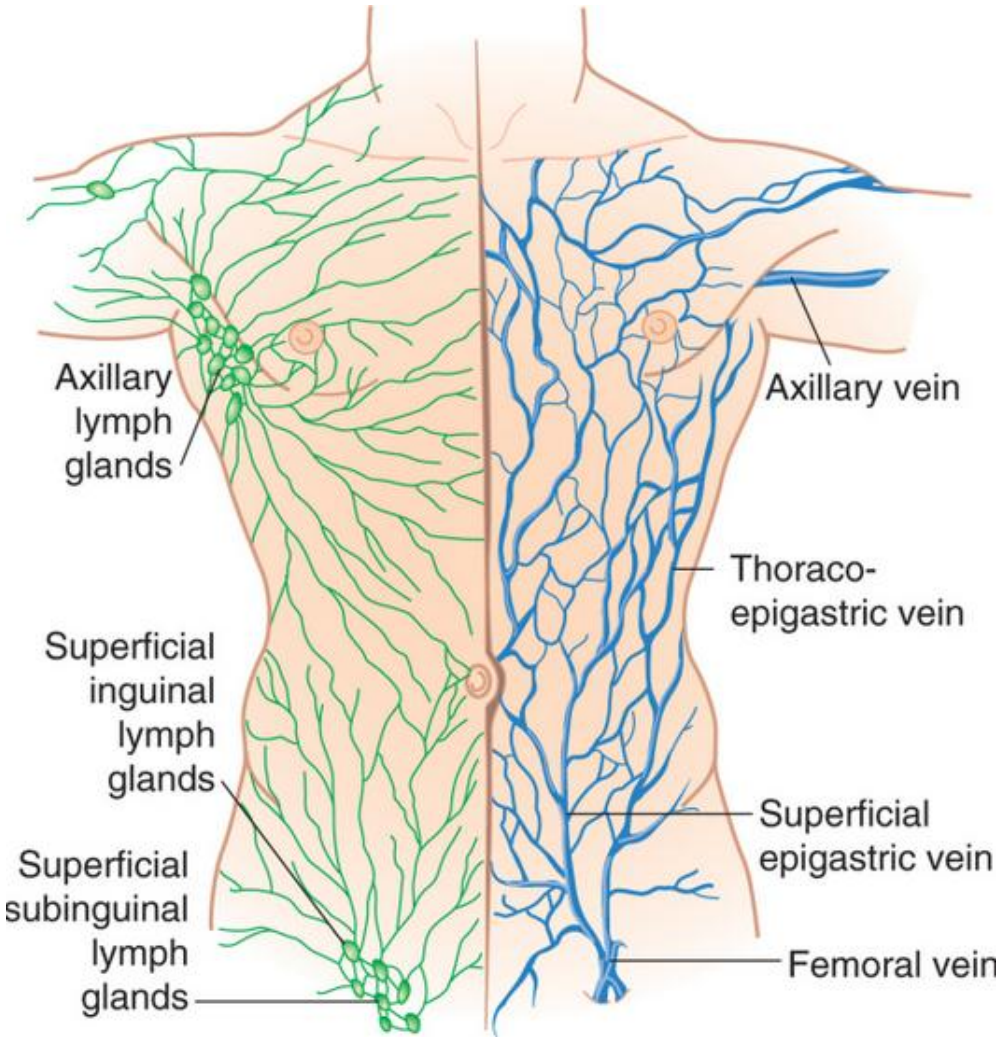
1- Cremastric artery – supply the cord covering layers
2- Pubic branch – if enlarged forms the aberrant obturator artery
3- Muscular branches
4- Cutaneous branches

The superior and inferior epigastric collaterals open up when there is obstruction at the level of thoracic or abdominal aorta

Posterior intercostal, subcostal and lumbar arteries and veins;

Posterior intercostal, subcostal and lumbar arteries run through the Aponeurosis of transversus abdominis and lie deep to the internal oblique. The arteries run on either side forward, giving off muscular branches to overlying internal and external oblique and anastomoses with the lateral branches of the superior and inferior epigastric arteries at the level of lateral border of the rectus sheath.

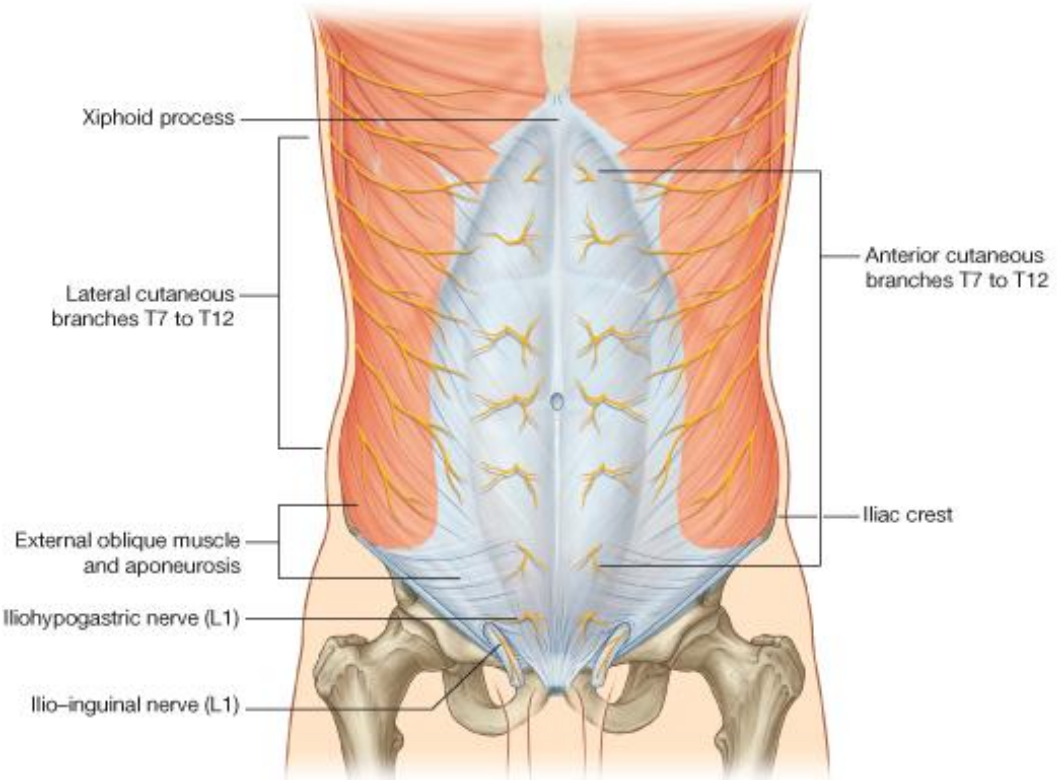
Lymphatic drainage;



Lymph vessels lie superficial and deep to deep fascia. Superficial lymphatic's accompany the subcutaneous vessels. Those in the infra umbilical region drain to superficial inguinal and supra umbilical region drain to pectoral and subscapular axillary lymph nodes.

Deep lymphatic's accompany deep arteries. Vessels from the posterior portion of the abdominal wall drain into lateral aortic and retro aortic nodes. Vessels from upper anterior abdominal wall run along with the superior epigastric vessels to Para sternal nodes. Lower abdominal wall drain into circumflex iliac, inferior epigastric and external iliac nodes.

Segmental nerves



Seventh to twelfth lower thoracic ventral rami continue anteriorly from the intercostal space into the abdominal wall.

7^{th} and 8^{th} nerves

Run through the Aponeurosis pass posterior to rectus supply and branches to the upper portion of the muscle.

9^{th}, 10^{th} and 11^{th} nerves –

9^{th} nerves supply the skin above the umbilicus

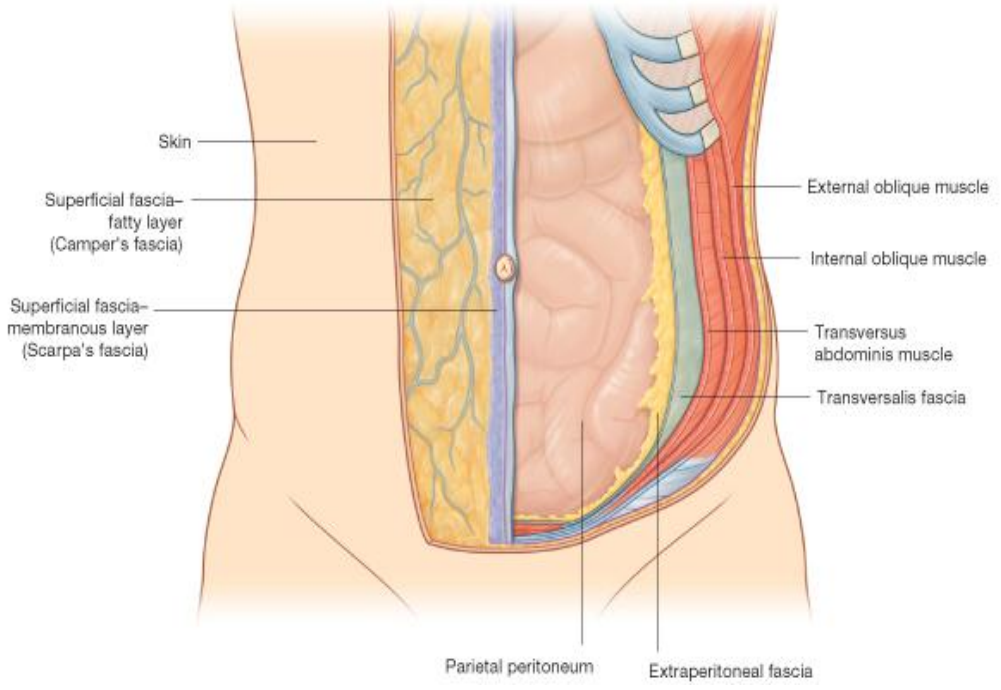
10^{th} nerve supply the umbilicus

11^{th} supply below the umbilicus

12^{th} thoracic nerve –

Also called subcostal nerve communicate with the first lumbar nerve

SOFT TISSUE;



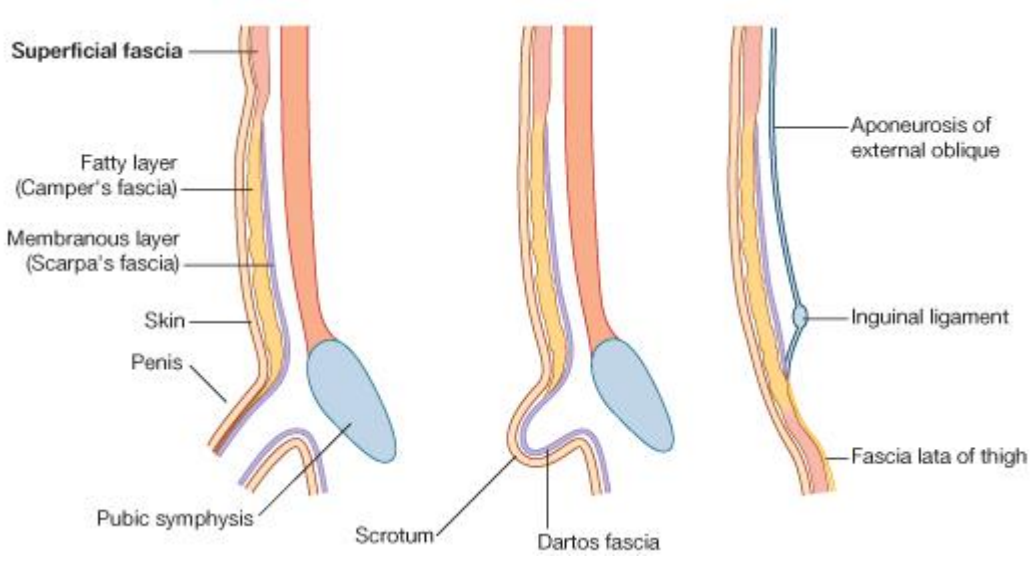
SUPERFICIAL FASCIA;

Superficial fascia consists of a single layer that contains variable amount of fat. It lies between the skin and the muscles of the anterior abdominal wall. The fascia differentiated into superficial and deep layers between which lies superficial vessels and nerves and in the groin which contains superficial inguinal lymph nodes.

Superficial layer;

It is a thick areolar layer containing variable amount of fat. This layer continues to the thigh as the superficial fascia of the thigh and in the scrotum it form the fascia of dartos muscle in combination with smooth muscle fibers.

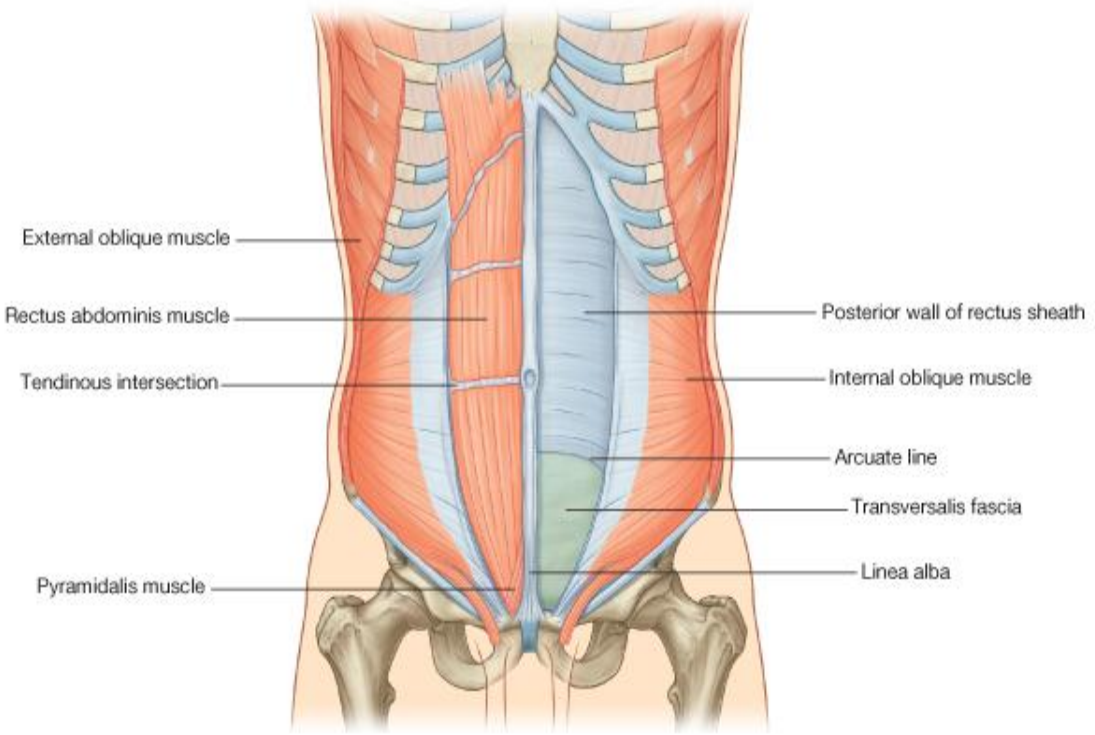
Deep membranous layer;



It is membranous and contains elastic fibers. It is loosely connected by areolar tissue to the Aponeurosis of external oblique and adherent to

the linea Alba in the midline. In males it forms the superficial ligament of penis. It fuses with the overlying superficial layer and the fascia lata at thigh, continues with the membranous layer of the superficial fascia of the perineum.

ANTERIOR ABDOMINAL MUSCLES;



The following muscles constitute the antero lateral muscles of abdomen

1- Rectus abdominis

2- Pyramidalis

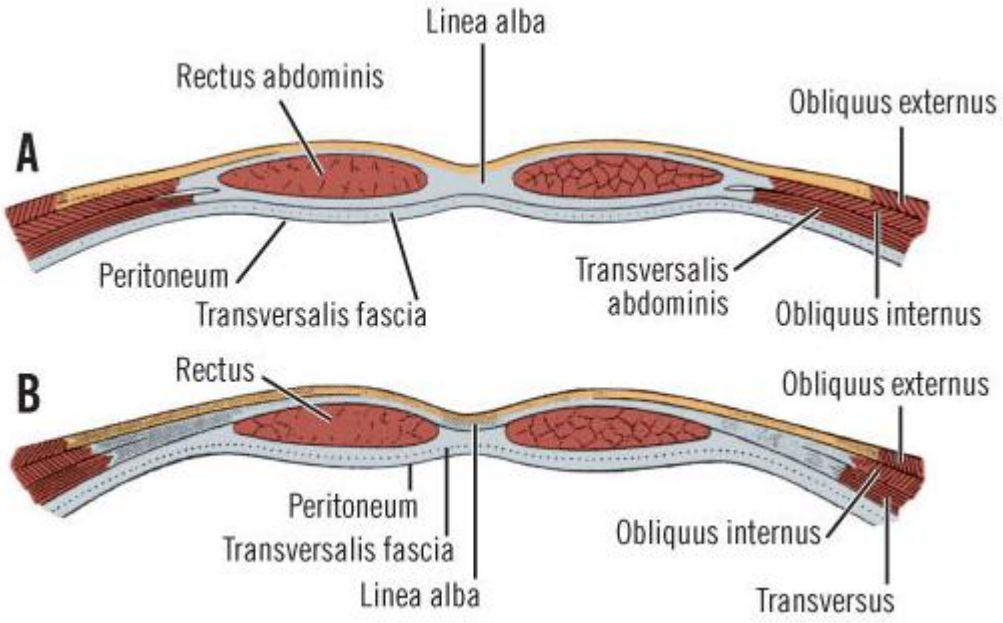
3- External oblique

4- Internal oblique

5- Transverse abdominis

In prune belly syndrome there in congenital absence of these muscles. Antero lateral abdominal muscles constitute little to movement of the trunk during normal sitting and standing however these are required for movements of the trunk against resistance or when the individual is supine. Rectus abdominis is the most important flexor in these situations.

RECTUS ABDOMINIS;



It is a long strap like muscle widest in the upper abdomen. Linea Alba separates the paired recti. Rectus abdominis is interrupted by three fibrous bands or tendinous intersection first at the umbilicus second at the xiphoid process and third midway between these two. Lateral border is called the linea semilunaris extending from pubic tubercle to the ninth costal cartilage.

Origin *;* pubic crest, pubic tubercle

Insertion; 5^{th} 6^{th} and 7^{th} costal cartilage, xiphoid

Blood supply;

1- Superior epigastric arteries
2- Inferior epigastric arteries
3- Lower three posterior intercostal arteries
4- Subcostal arteries
5- Posterior lumbar arteries
6- Deep circumflex artery

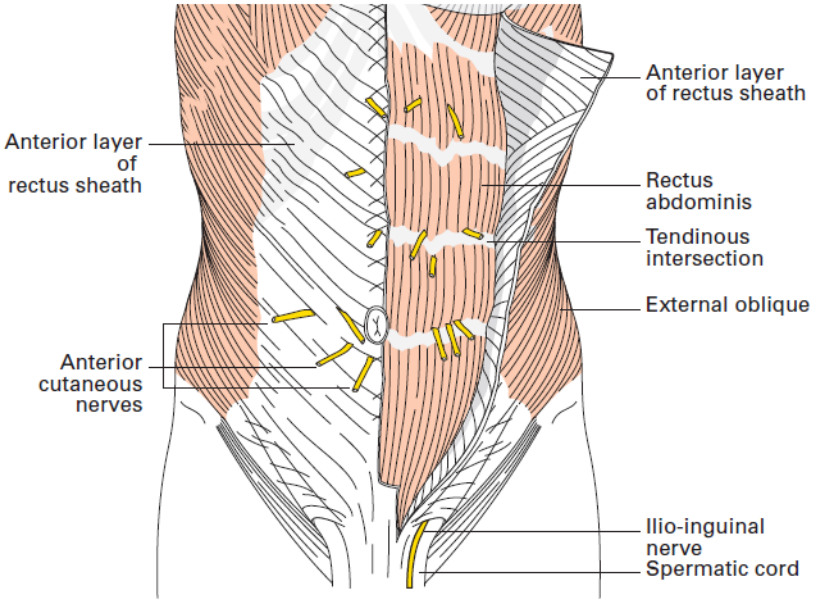
Nerve supply;

Lower 6 or 7 thoracic spinal nerves via lower intercostal and subcostal nerves.

Action;

Contributes to flexion of the trunk and abdominal tone during straining.

RECTUS SHEATH;



Formed from decussating fibers from all three lateral abdominal muscles.[3] It is a fibrous sheath which encloses on each side of rectus abdominis. Anterior portion of this sheath extends over the entire length of the muscle. Posteriorly the sheath is complete in the upper 2/3rd where as in the lower 3rd posterior sheath stops midway between the umbilicus and pubis. Arcuate line is the lower border of the posterior sheath. Below this rectus abdominis lined only by transversalis and extra peritoneal connective tissue enclosed posteriorly. Anterior sheath- composed of leaves of the Aponeurosis of external oblique and anterior leaf of Aponeurosis of internal oblique.

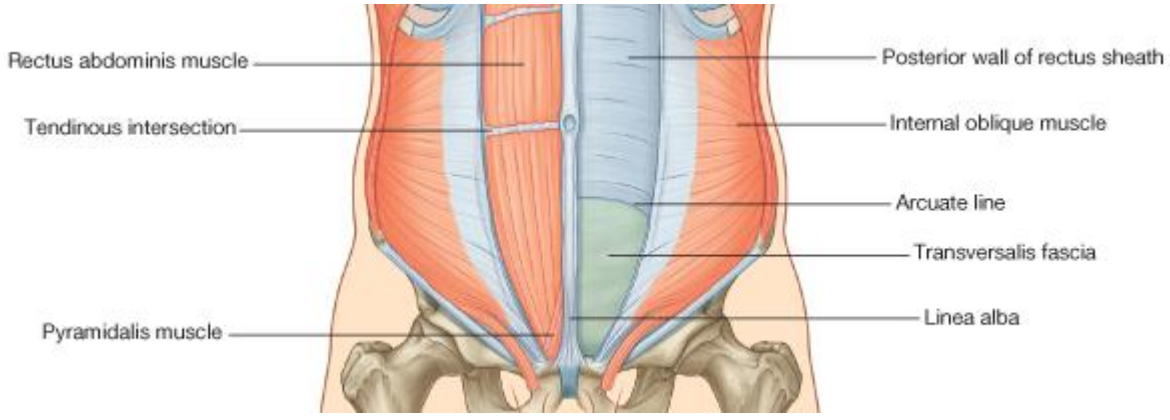
Posterior sheath- comprised of posterior leaf of Aponeurosis of internal oblique and leaves of the Aponeurosis transversus abdominis.

At the midline anterior and posterior layer are closely approximated and fibers of each layer decussate to the opposite side of sheath. Antero posterior decussation of fibers occurs crossing from anterior to posterior sheath. This dense fibrous line is called line Alba.

LINE ALBA;

It is a tendinous raphe extending from the xiphoid process to symphysis pubis and pubic crest. Lies in between the two recti. Above the umbilicus linea Alba is border below which is narrower. Umbilicus lies just below the midpoint of linea Alba. '***adminiculum linea alba*** is the posterior attachment of linea alba. Divarication of recti is a condition in which there is thinning and widening of linea Alba as a result of obesity or chronic straining, it is not a true herniation since all three layers are intact. Umbilical hernia occurs through a defect at umbilicus and Para umbilical hernia result when herniation occur just above or below the umbilicus.

PYRAMIDALIS;



It is a triangular muscle in front of the lower part of rectus abdominis within the rectus sheath. It is attached by ligamentous fibers in front of the pubis and by tendinous fibers to front of the pubis. Muscle diminishes in size as it runs upwards and ends in a pointed apex which is attached medially to the linea Alba. The attachment usually lies midway between the umbilicus and pubis. It may be large on one side and smaller on the other side.

Blood supply;

1- Inferior epigastric artery

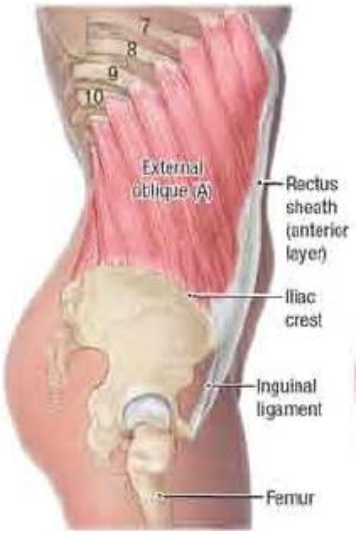
2- Deep circumflex iliac artery

Nerve supply;

Terminal branches of subcostal nerve [T 12]

Action; Pyramidalis contributes to tensing the lower line alba but of physiological significance.

EXTERNAL OBLIQUE;



Most superficial and largest muscles of three lateral abdominal muscles. Fibers move in a downward forward and medial direction. Has a free posterior border. The long free anterior border forms the inguinal ligament.

Origin; lower 8 ribs [5 to 7]

Insertion; anterior half of iliac crest, linea Alba

Blood supply;

1- Lower posterior intercostal arteries

2- Subcostal artery

3- Superior epigastric artery

4- Inferior epigastric artery

5- Superficial circumflex artery

6- Deep circumflex artery

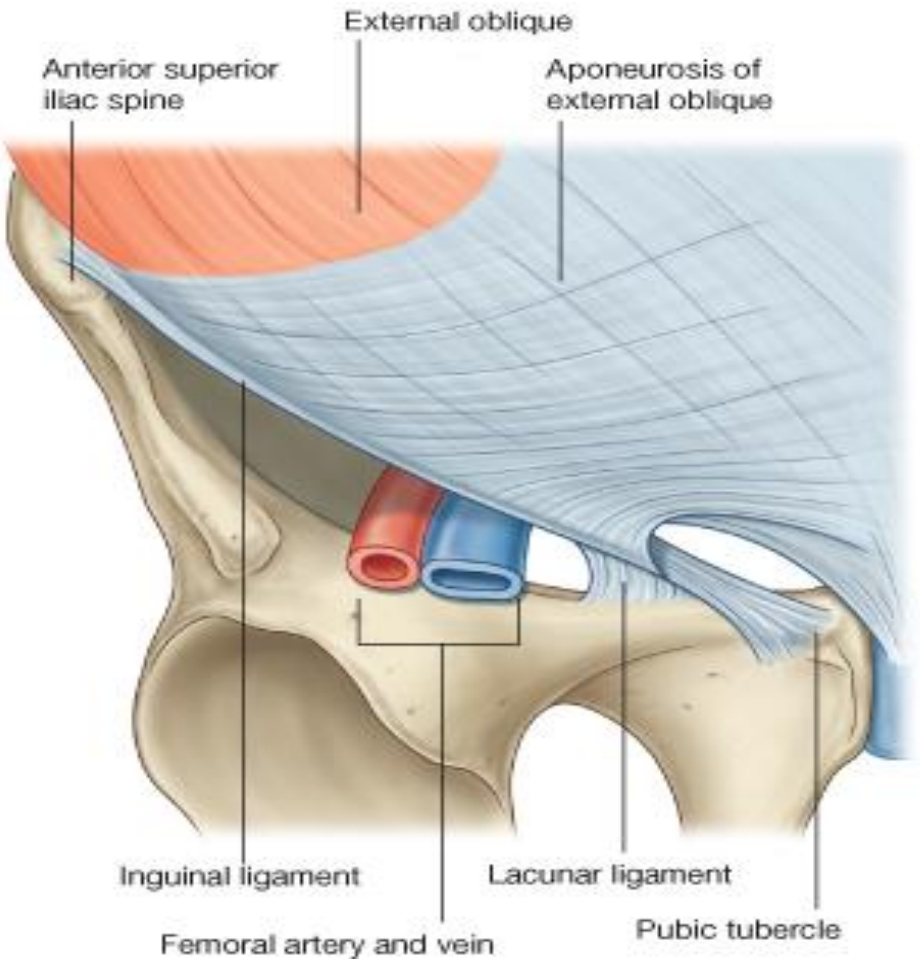
7- Posterior lumbar artery

Nerve supply;

1- Lower 5 intercostal nerves

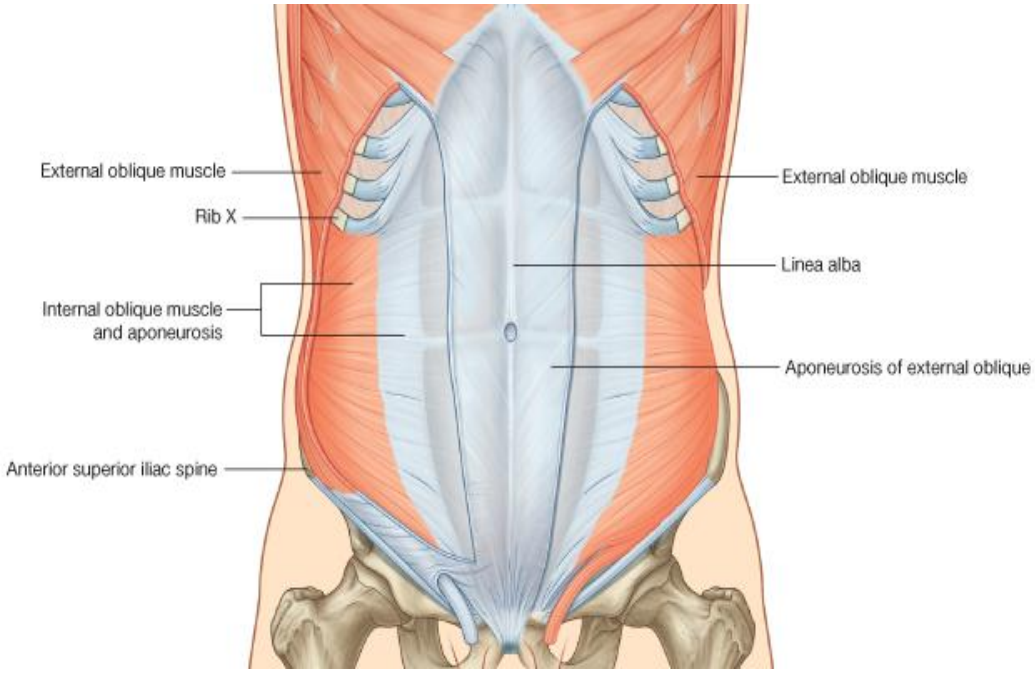
2- Subcostal nerves

INGUINAL LIGAMENT;



It is thick in rolled lower border of Aponeurosis of external oblique. It stretches from pubic tubercle to anterior superior iliac spine. Its grooved abdominal surface forms the floor of the inguinal canal. Lacunar ligament is posterior lateral extension of inguinal ligament along the pectineal ligament. Some fibers of inguinal ligament pass upwards and medially behind superficial inguinal ring to form the reflected part of inguinal ligament.

INTERNAL OBLIQUE;



Lies deep to external oblique and is less bulky and thinner than external oblique. Also has a short free lower border. Upper fibers run upwards, forwards medially whereas the lower fibers run in a downwards, forwards and medially.

Origin; lateral 2/3rd of grooved upper surface of the inguinal ligament, thoraco lumbar fascia Insertion; lower 4 or 3 ribs and cartilages, linea Alba, pubic crest

Blood supply;

1- Lower posterior intercostal arteries
2- Subcostal artery
3- Superior epigastric artery
4- Inferior epigastric artery

5- Superficial circumflex artery

6- Deep circumflex artery

7- Posterior lumbar artery

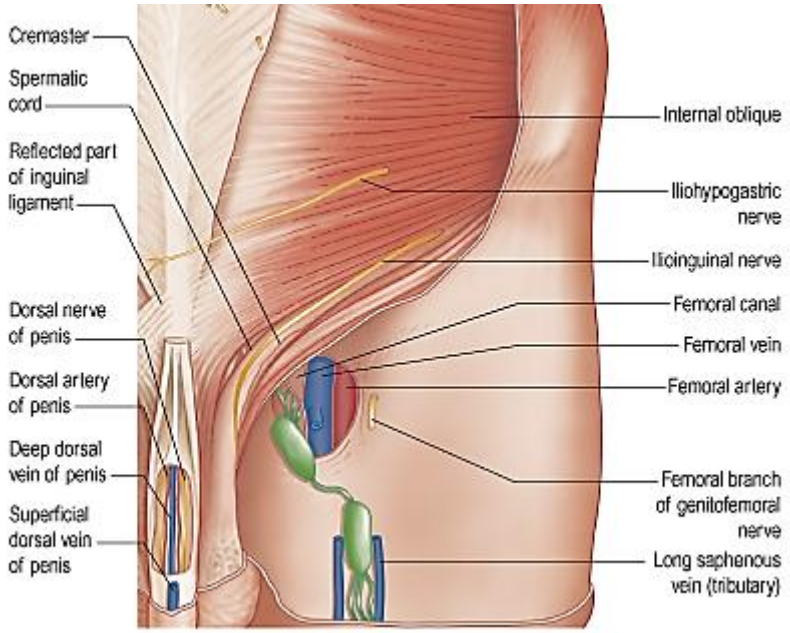
Nerve supply;

1- Lower 5 intercostal nerves

2- Subcostal nerves

3- Small contributions from ilio hypo gastric and ilio inguinal nerves

CREMASTER;



Cremaster form an incomplete coating around the cord called Cremastric fascia. Origin; inferomedial border of internal oblique and transverse abdominis Insertion; medial portion attached to pubic tubercle and pubic crest lateral part

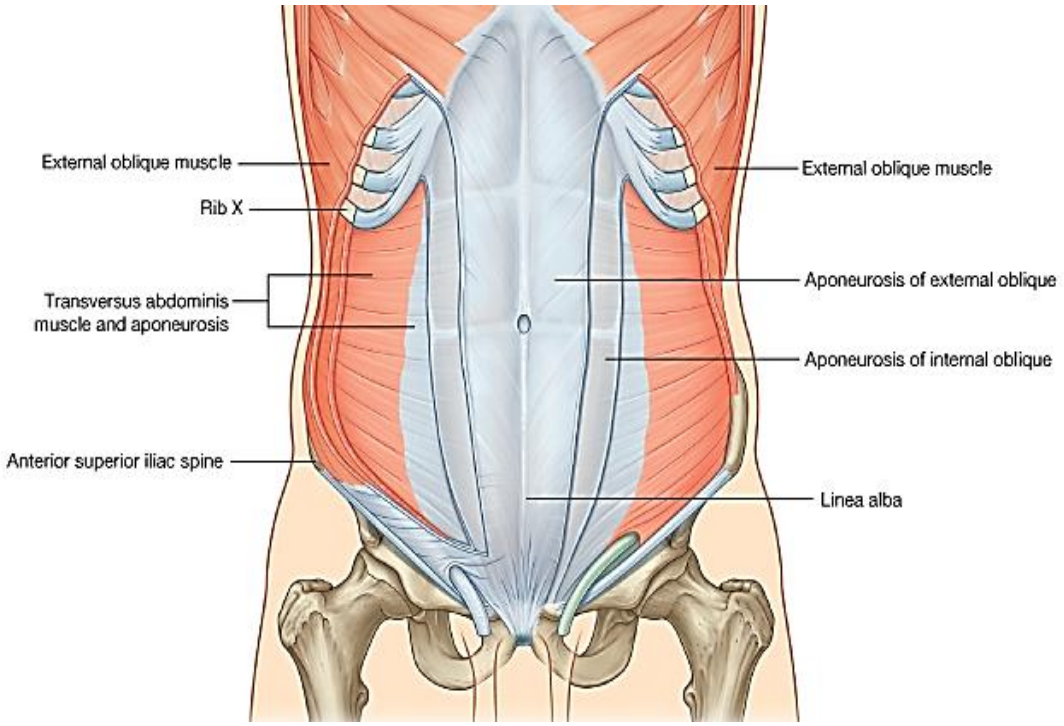
Blood supply;

Cremastric artery branch of inferior epigastric artery

Nerve supply;

Genital branch of the genito femoral nerve [L1,L2] Action; Pulls testis up towards the superficial inguinal ring. Not under voluntary control even though it is striated.

TRANSVERSUS ABDOMINIS;



All of its fibers run transverse except for the lower fibers which run obliquely. It is the deepest layer of the lateral abdominal wall. Has a short free border.

Origin; lateral 1/3rd of inguinal ligament, anterior 2/3rd of inner lip of anterior segment of iliac crest, lower 6 costal cartilages, thoracolumbar fascia

Insertion; linea Alba, pubic crest

Blood supply;

1- Lower posterior intercostal arteries

2- Subcostal artery

3- Superior epigastric artery

4- Inferior epigastric artery

5- Superficial circumflex artery

6- Deep circumflex artery

7- Posterior lumbar artery

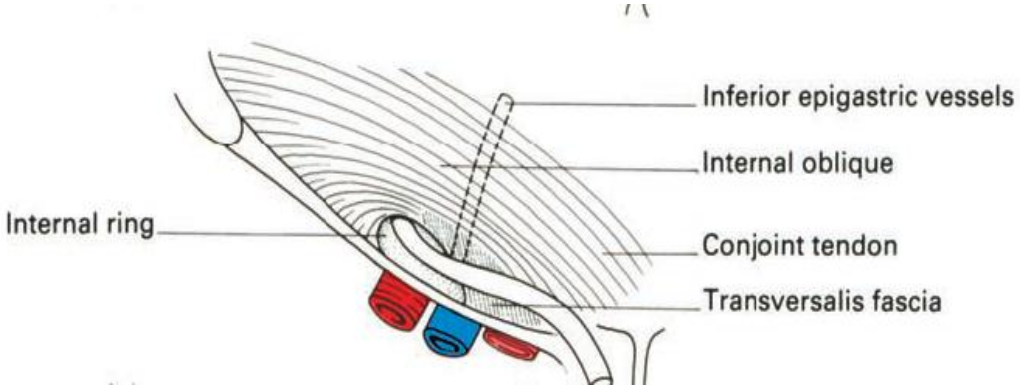
Nerve supply;

1- Lower 5 intercostal nerves

2- Subcostal nerves

3- Small contributions from iliohypogastric and ilio inguinal nerves

CONJOINT TENDON;



Formed from lowest part of Aponeurosis of transversus abdominis and lower fibers of internal oblique. Descends behind the medial superficial inguinal ring and strengthens the medial portion of posterior wall of inguinal canal. Upper fibers fuse with anterior wall of rectus sheath medially and blend with inter foveolar ligament laterally.

TRANSVERSALIS FASCIA;

It is a thin layer of connective tissue lying between the extra peritoneal fat and transversus abdominis. It continues with the iliac and pelvic fascia. Anterior to femoral vessels fascia extends down from the fascia transversalis to form the femoral sheath anterior layer. Round ligament in female and spermatic cord in males pass through deep inguinal ring which is a defect in transversalis fascia.

EXTRA PERITONEAL CONNECTIVE TISSUE;

It is a layer of areolar tissue lying between the peritoneum and the transversalis fascia. It contains much adipose tissue around the kidneys

and variable in thickness on the anterolateral wall and thicker in the obese.

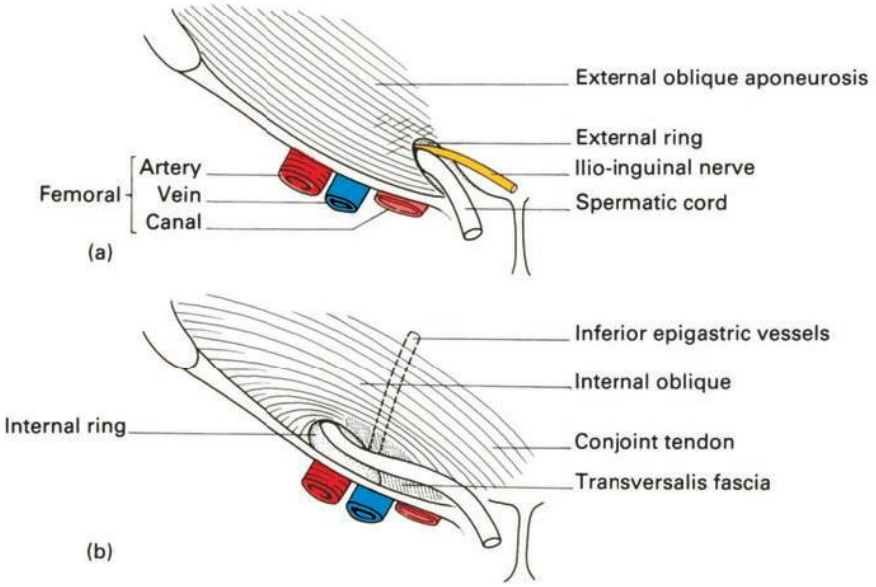
SUPERFICIAL INGUINAL RING;

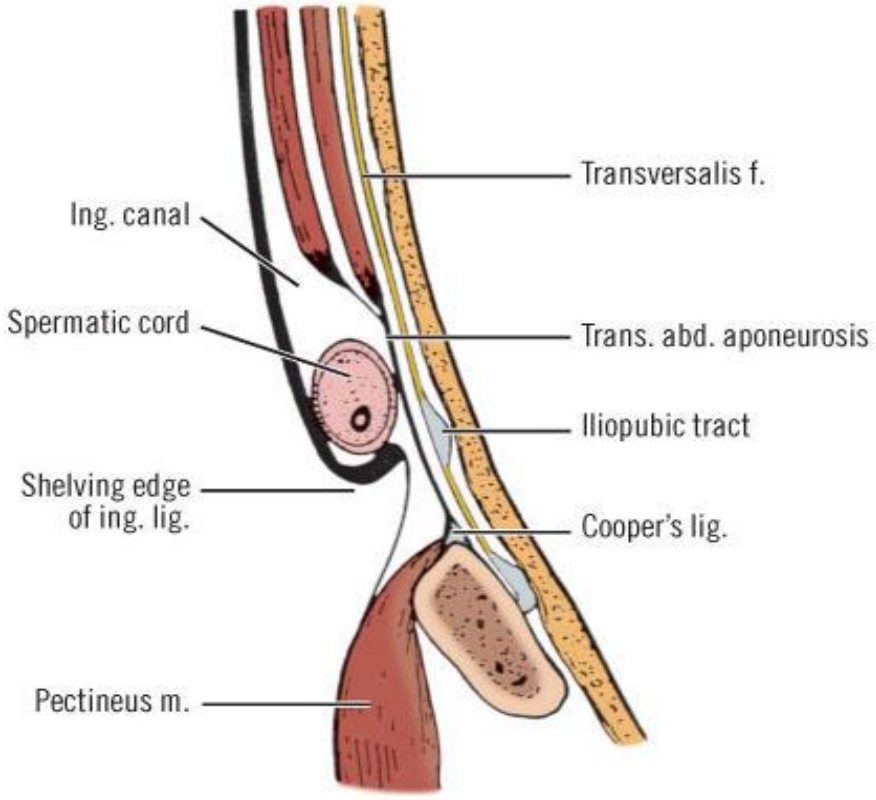
Is a defect in the Aponeurosis of external oblique just above and lateral to the crest of pubis and is triangular in shape, base lies over the crest of pubis and in males the spermatic cord lies over the groove formed by the lateral crus. Ring in females is smaller.

DEEP INGUINAL RING;

It is a defect in transversalis fascia midway between the anterior superior iliac spine and pubic symphysis and is 1.25cm above the inguinal ligament. It is oval in shape with long axis lying longitudinally. Ring is larger in male and smaller in females. Ring is related medially to inferior epigastric vessels and the inter foveolar ligament and to the arched lower margin of transversus abdominis. Traction to the ring constitutes a valve like safety mechanism when intra-abdominal pressure is increased.

Inguinal canal;



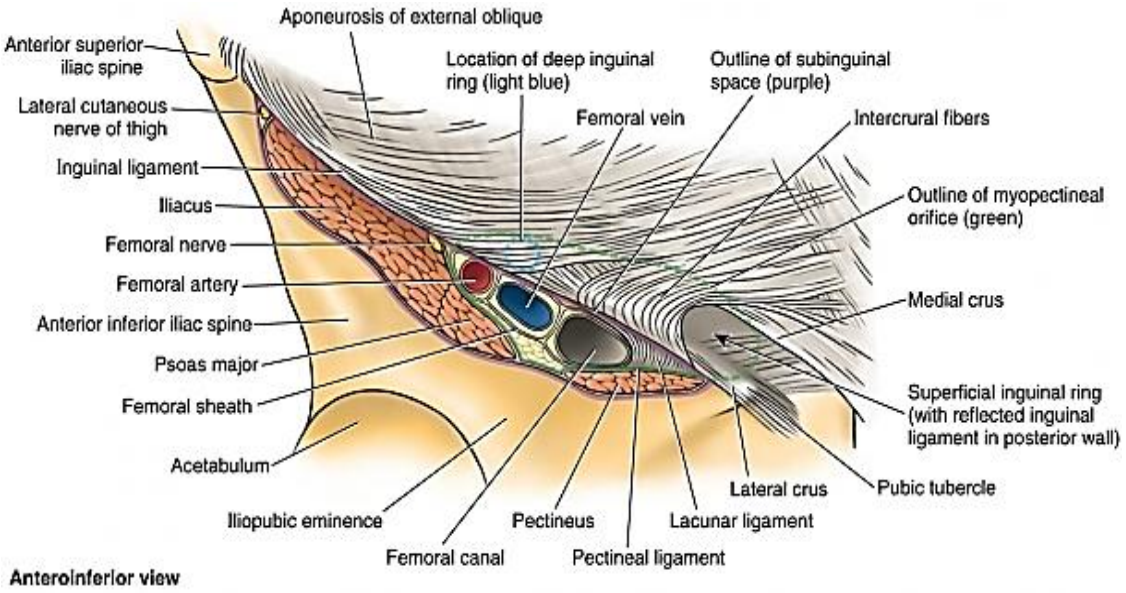


In adults it is 3- 5 cm long and lies 2 – 3 cm above the femoral artery.

Boundaries;

Anterior- skin, superficial fascia, Aponeurosis of external oblique Posterior- transversalis fascia, conjoint tendon and reflected part of inguinal ligament medially Superiorly- arched fibers of internal oblique and transversus abdominis forming the conjoint tendon Inferiorly- inguinal ligament and lacunar ligament medially The inferior epigastric artery lies medial to the canal

LACUNAR LIGAMENT;



It is a thick triangular band of tissue lying posterior to the medial end of inguinal ligament, measures 2cm approximately, formed by fibers from inguinal ligament medially and fibers from fascia lata of thigh below. It forms a triangular sheet with a curved medial border which forms the medial border of the femoral canal. Apex is attached to the pubic tubercle.

ABDOMINAL WALL INCISIONS;

Primary requirements for incision;

1- Exposure/ accessibility;

a. Provides optimal direct exposure to diseased organ or injured area

b. Provide adequate space so surgery can be performed directly and rapidly.

2- Flexibility;

a. Vertical midline incision is better since if the incision needs to be extended the only limitation are the xiphoid above and symphysis below.

b. Transverse and oblique incision are amenable in extension but any enlargement should limit sacrifice of nerves that supply abdominal musculature. It is ideal to sacrifice one or none on each side irrespective of length of incision.

3- Reliability/ security;

a. An incision be placed in such a way that it does not interfere with further stages of planned surgery. It should be placed to avoid or in corporate existing sinuses, fistulas, colostomies.

Poorly placed incisions and unsatisfactory method of closure lead to complications leading to

1- Hematoma

2- Stich abscess

3- Infection

4- Wound dehiscence

5- Wound evisceration

6- Incisional hernia

7- Unsightly scar

TYPES OF ABDOMINAL INCISIONS;

Common types of abdominal incision are classified broadly as

1- Vertical incision

a. Midline

i. Full midline – xiphoid to symphysis pubis

ii. Upper midline – tip of xiphoid to 1 cm above umbilicus

iii. Lower midline

b. Paramedian

i. Lateral paramedian incision

ii. Medial paramedian incision

iii. Vertical muscle splitting incision

c. Pararectus

d. Supra umbilical

e. Infra umbilical

f.

2- Transverse or oblique incision

a. Kocher's sub costal incision

b. Left sub costal incision

c. Rocky Davis incision

d. McBurneys incision

e. Pfannenstiens incision

f. Arrow head/ bilateral sub costal / bucket handle incision

g. Supra umbilical Transverse or oblique incision- 2cm above umbilicus

i. Unilateral

1. Right sided

2. Left sided

ii. bilateral

h. Infra umbilical Transverse or oblique incision- 2cm below umbilicus

i. Unilateral

1. Right sided

2. Left sided

ii. bilateral

3- Retroperitoneal / extra peritoneal approach incision

4- Thoraco abdominal or abdomino thoracic incision

5- Separate thoracic and abdominal incisions

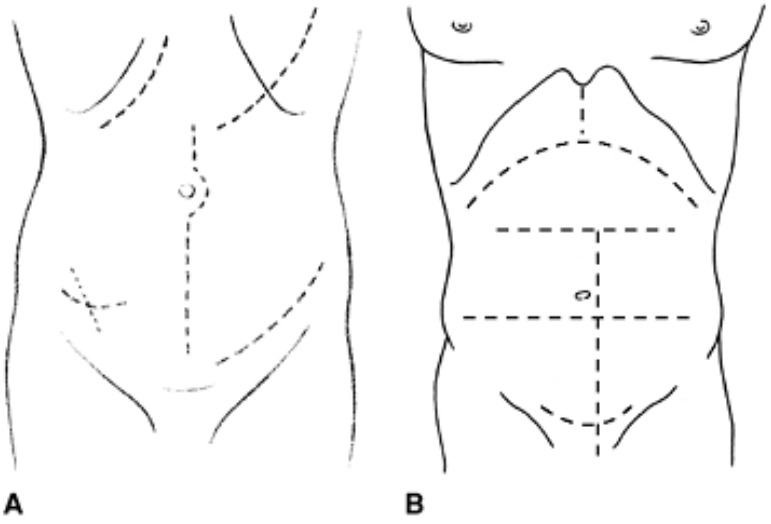


Fig. 1. Common types of incisions. **A:** Clockwise from the upper right quadrant are subcostal (Kocher), thoracoabdominal, left lower quadrant (extraperitoneal), vertical midline, and Rockey-Davis (transverse)/McBurney (oblique). **B:** From superior to inferior are bilateral subcostal with vertical T extension, supraumbilical transverse, infraumbilical transverse, left paramedian, and Pfannenstiel incision.

CHOICE OF MAKING AN INCISION;

Varies with surgeons [31]

1- Preference,

2- Experience,

3- The organ to be visualized

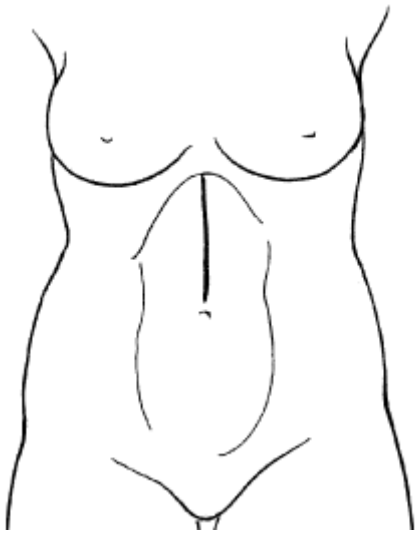
4- Presence of previous scar – incision made through the previous incision and scar should be excised

5- Degree of obesity

6- Whether rapid access required

7- Whether ileostomy or colostomy is a part of operation – main wound kept far away either midline or opposite Para median

VERTICAL INCISION;



Incision is deepened through the skin, subcutaneous fat, linea Alba, properitoneal fat and peritoneum. Near the umbilicus the incision is carried in a curvilinear manner. Properitoneal fat in obese is abundant and medium sized vessels may be encountered. If falciform ligament interferes with incision it should be clamped divided and ligated. Upper midline provides adequate exposure of esophageal hiatus, abdominal esophagus, stomach, duodenum, gall bladder[15] and spleen. [6]

Lower midline provides good exposure for most operations on lower abdominal and pelvic organs. On making full incision peritoneum should be incised near the umbilicus to avoid injury to bladder, care should be taken if bowel is distended. Safe method is to pick up a fold of peritoneum with pair of toothed forceps, palpate to ensure no other structures has been caught and then carefully incise the raised fold with scalpel. Small opening in peritoneum is enlarged to accommodate two fingers which are used protect the underlying viscera while the peritoneum is opened throughout the incision.

When opening on previous scar the incision should begin 3 to 4cm beyond the previous scar so that peritoneum can be opened up at that site. Closure of fascia in one layer with peritoneum is the technique most surgeons use. Bite should be at least 1.5 – 2.0 cm from cut edges.

Advantages of vertical incisions;

1- incision mad rapidly – fastest

2- can be quickly extended up to xiphoid and pubis

3- preferable in thin patient with very narrow costal angle

4- offer adequate exposure of almost any part of abdomen and retro peritoneum

5- closure is satisfactory

6- bloodless almost and no muscle is divided and no nerves are injured

7- practical incision for

a. abdominal trauma

b. disease process not known in acute abdomen

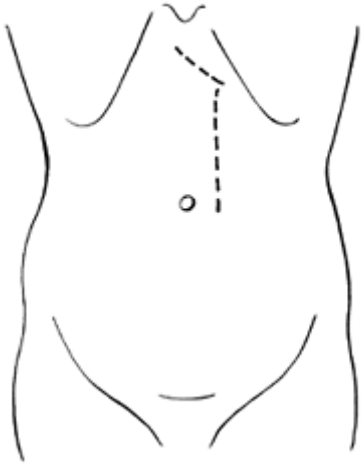
c. inspect GIT bleeding when the site is not known

Dis advantages;

1- The sutures are parallel to the fiber orientation and can tear or cut through the fascia

2- incisional hernia is 5 times more common with vertical than transverse

PARAMEDIAN INCISION;



It is vertical incision made 2.5cm to 4cm from midline deepened through the subcutaneous fat up to anterior rectus sheath which is opened through whole length of the wound no more than 2 to 3cm from midline. Medial portion of anterior rectus fascia is dissected to the muscle dissection may be difficult in the upper abdomen due to tendinous attachments of rectus muscle to the anterior fascia.[8]

Segmental vessels are encountered when the tendinous inscriptions are released and require electro coagulation or ligation. once the muscle is freed anteriorly and medially it is retracted laterally by a ribbon retractor because it is not adherent to posterior fascia. Posterior rectus sheath is then incised vertically for the length of skin incision.

Lateral Para median incision;

Incision made several cm's lateral to traditional Para median. Incision placed at the junction of middle and outer 3rd of the width of the rectus sheath.[10]

Advantages;

1- Limits trauma to rectus

2- Allows anatomical and secure closure

3- Good restoration of function

4- If needed can be extended by sloping the upper end of incision medially towards the xiphoid [***MAYO ROBSON*** incision]

VERTICAL MUSCLE SPLITTING INCISION

Performed in the same way as Para median except that the rectus muscle is split longitudinally in its medial 3rd after which the incision on the posterior rectus sheath and peritoneum is the same. This method of incision is used for placement of TENCHHOFF peritoneal dialysis catheter.

Advantages;

1- Used in previous Para median incision in which dissecting the rectus muscle from scar tissue of anterior rectus sheath is very difficult and a muscle split may therefore be appropriate.

Dis advantages;

1- More bleeding than vertical or Para median

2- More injury to nerve and muscle than vertical or Para median

TRANSVERSE OR OBLIQUE INCISION;

Incision is horizontal or may curve to varying degrees.[11]

Advantages;[2]

1- Adequate exposure can be obtained

2- Direction of pull of lateral abdominal muscles is in line with or roughly parallel to the incision and less distracting tension occurs on the wound edges than vertical incisions.

3- Wounds are stronger

4- Less liable to dehiscence or herniation unless wound infection present

5- Less post-operative pain than vertical incisions

6- Preferable in short patient's with wide costal angles

7- Rocky Davis muscle splitting incision for appendicectomy is ideal and can be easily extended medially or obliquely laterally [WEIR extension]

8- Mostly follow langer lines and gives better cosmetic results.

9- Provide adequate exposure in abdomen

10- When closed have substantially more intrinsic strength than vertical ones

11- Post-operative complications less common and include

a. Severity of pain
b. Wound dehiscence
c. Early post-operative pulmonary complication

Dis advantages;

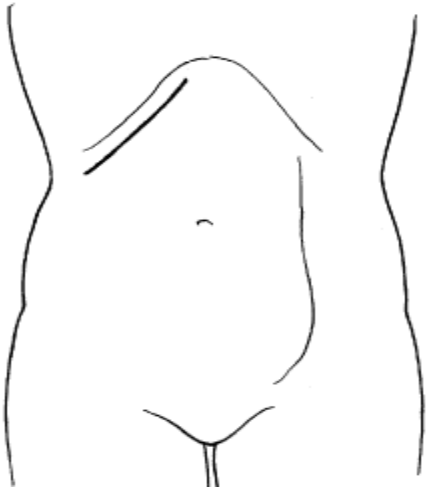
1- More time consuming to make than midline incisions

2- Gives limited exposure if disease is found in both upper and lower abdomen

3- In extended left hemi colectomy exposure may not be satisfactory because of exposure of splenic flexure and distal sigmoid simultaneously may be difficult

4- In infra umbilical incision the rectus muscle retracts since there is no tendinous inscriptions at this area

KOCHER'S SUBCOSTAL INCISION;



It is right sub costal incision. Made for operations on gall bladder and bile duct.[13] Incision starts in midline 2.5cm to 4cm below the xiphoid and extended laterally up to 2.5cm below the costal margin. If liver is enlarged incision should be placed lower.

After the rectus sheath is incised the rectus muscle is divided along the course of the wound and branches of superior epigastric other blood vessels controlled. Lateral abdominal muscles divided for a variable distance, 8^{th} intercostal nerve divided and 9^{th} inter costal nerve preserved.

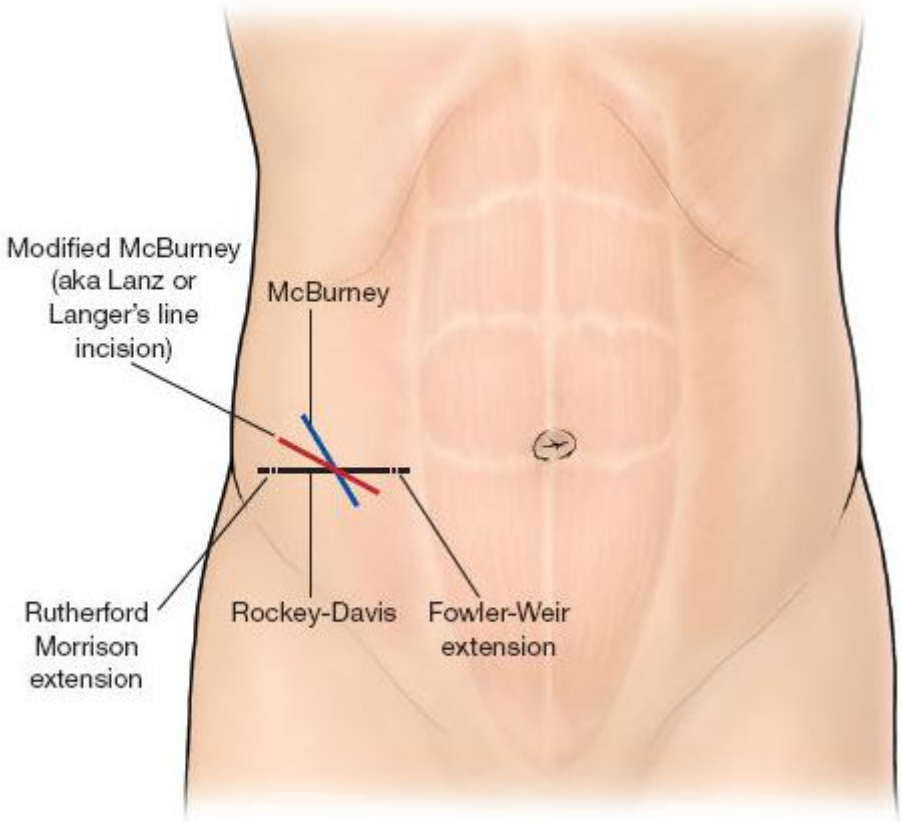
Incision deepened to open the peritoneum. Although rectus is divided no weakness occurs provided the anterior and posterior sheaths are repaired. Incision is repaired in 2 layers. Posterior fascia and peritoneum are the deeper layer and the second layer is the anterior and

the Aponeurosis of external oblique. Subcutaneous layer is not sutured separately.

LEFT SUB COSTAL INCISION;

Left sided sub costal incision is made for elective splenectomy. Other procedures are as above.

ROCKY DAVIS INCISION;



It is a transverse skin crease incision[14] which is cosmetically superior and performed for appendicectomy or cecostomy. Location and length of the incision depends on the position of appendix. External

oblique split opened along its direction of fibers, internal oblique split along the direction of its fibers.

Alternatively closed Kelly clamps can be inserted into the muscle perpendicular to direction of fibers and opened to split the muscles. A small opening is made in the peritoneum transversely and enlarged as much as necessary. If needed incision be enlarged medially opening the anterior rectus and laterally [WEIR extension] through the antero lateral muscles.

Peritoneum and transversalis fascia closed with running absorbable suture, transverse and internal oblique are closed as a single layer by closing the investing fascia at the anterior surface of internal oblique. External oblique is closed with interrupted absorbable sutures. If pus or fecal material is present in the abdomen the skin and subcutaneous tissue are packed open. Similar incision on the left side can be used for performing a sigmoid colostomy.

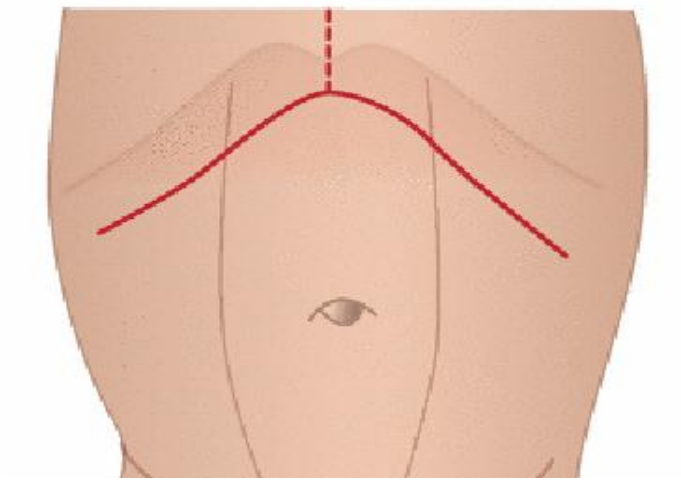
MC BURNEYS INCISION;

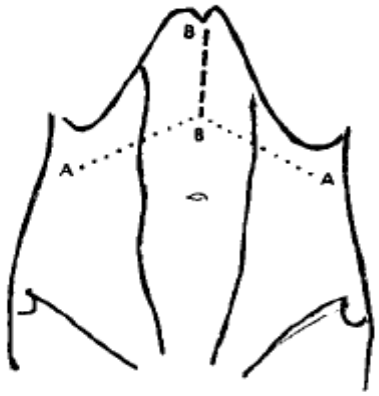
It is a obliquely placed incision made over the McBurneys point which is the midpoint of lateral 1/3rd and medial 2/3rd of an imaginary line drawn between the anterior superior iliac spine and umbilicus. Other procedures are as for rocky Davis incision.

PFANNENSTEIL INCISION;

Used for gynecological procedures and in males used for extra peritoneal retro pubic prostatectomy[12][38]. Foleys catheterization should always be done before making an incision. Skin incision made approximately 5cm above the pubic symphysis. Both recti are divided transversely and upper and lower edges are elevated. Rectus muscle then retracted laterally peritoneum opened vertically to protect the bladder.

ARROW HEAD/ BILATERAL SUB COSTAL / BUCKET HANDLE INCISION;





A: Rooftop incision; B..: Mercedes Benz extension

Incision is parallel to and 2 to 3 cm below the costal margin.

Useful for

1- Total gastrectomy

2- Major liver resection

3- Pancreatic operation

4- Hepatic transplantation

SUPRA UMBILICAL [UPPER TRANSVERSE INCISION]

Incision made 2cm above the umbilicus

1- Unilateral-

a. Right sided transverse incision

i. Ideal for surgery on the cecum and ascending colon resection

b. Left sided transverse incision

i. Ideal for surgery on the left transverse colon and splenic flexure

2- Bilateral

INFRA UMBILICAL [LOWER TRANSVERSE INCISION]

Incision made 2cm below the umbilicus

1. Unilateral

a. Right sided transverse incision;

i. Ideal for surgery of distal half of small bowel, cecum, ascending colon and mid transverse colon

b. Left sided transverse incision;

i. Ideal for operation on proximal half of small bowel

2. Bilateral

RETROPERITONEAL AND EXTRAPERITONEAL APPROACHES;

Incision are used for operation on the kidney, ureter, adrenal gland, bladder, splenic artery and vein, lumbar symphathetic chain, vene cava, abdominal aorta, common iliac, internal iliac and external iliac.

Advantages;

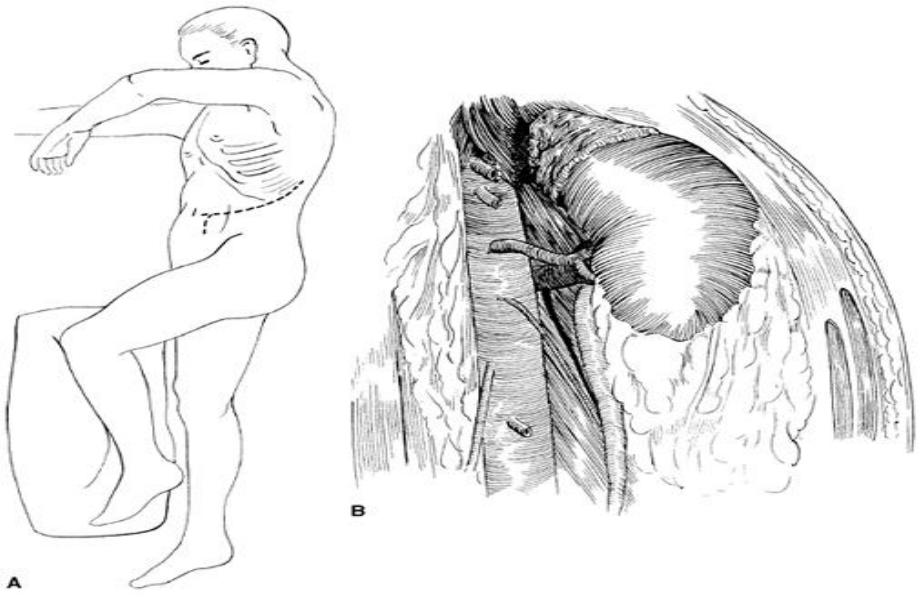
1- Decrease manipulation of intra-abdominal viscera and limit post-operative bleeding pus or urinary extravasation

2- Bleeding is much more tamponed here then when it occurs in the peritoneal cavity

3- Infection are more frequently localized here than in the abdomen

4- Post-operative ileus is reduced

RETRO PERITONEAL APPROACH TO THE LUMBAR AREA;



Used in;

1- Aortic surgery

2- Nephrectomy

3- Lumbar symphathectomy

4- Uretero lithotomy

Patient positioned supine with right side elevated 30 to 45 degree with knee and hip flexed. Incision begins at the level of umbilicus at the lateral margin of the rectus sheath and is extended into the flank towards the 12^{th} rib for 12 to 20cm. if needed rib portion can be removed with care not to injure the underlying pleura. Undermining of each layer is done to facilitate exposure.

When retro peritoneum is entered the peritoneum and retro peritoneal fat are moved forward [anteriorly] by blunt dissection with finger and sponge dissection. No dissection carried beyond psoas muscle. Sympathetic chain, ureter, lower pole of kidney are visualized and on the right side vene cava and on the left side aorta are visualized.

If peritoneum unintentionally entered it is sutured immediately with continuous absorbable suture. After the operation the retro peritoneal fat and viscera fall back into place and muscle layer are repaired with permanent absorbable continuous sutures.

RETRO PERITONEAL APPROACH TO ADRENAL GLAND;

Is the preferred open approach except in patient with large adrenal tumors, pheochromocytoma [explored trans abdominally] isolation and ligation of right adrenal vein at its junction with vene cava is the most critical step in right adrenalectomy.[22]

Advantages;

1- Less pain
2- Ileus is less
3- Fewer pulmonary complications

Patient placed in prone jack knife. Incision made 3 finger breath lateral to the midline over the 10^{th} rib towards the iliac crest [four finger breath lateral to posterior midline]. Incision deepened through subcutaneous fat,

posterior layer of the lumbodorsal fascia, the fibers of latissimus dorsi muscle which take origin from it. Erector spinae muscle is exposed which is retracted medially towards the spine to reveal the glistening middle layer of the lumbodorsal fascia and the 12^{th} rib.

Quadratus lumborum which is directly subjacent is visible through the lumbodorsal fascia. Several vessels through, nerves penetrate the fascia to enter the erector spinae muscles which are secured between clamps divided and ligated. With electro cautery attachments of the erector spinae to the 12^{th} rib are divided and the rib resected sub periosteally with care not to injure the underlying pleura.

Middle layer of lumbodorsal fascia is incised longitudinally along the lateral margin of the quadratus lumborum muscle to expose gerota's fascia which invest the kidney and perinephric fat. Intercostal vessels now become visible below and parallel to the resected 12 ribs. Intercostal nerve is retracted downwards while vessels are clamped divided and ligated.

Insertion of the posterior fibers of diaphragm into the periosteum of 12^{th} rib is divided and the glistening pleura is pushed out of the way. If pleura in inadvertently a large bore catheter is left in the pleural space and fascial layer closed snugly around the catheter, just before closure of skin the lungs are hyper inflated and the catheter is removed quickly.

RETRO PERITONEAL APPROACH TO ILIAC FOSSA;

Incision gives exposure to;

1- Distal ureter

2- Bladder

3- Common iliac vessels

4- Hypo gastric vessels

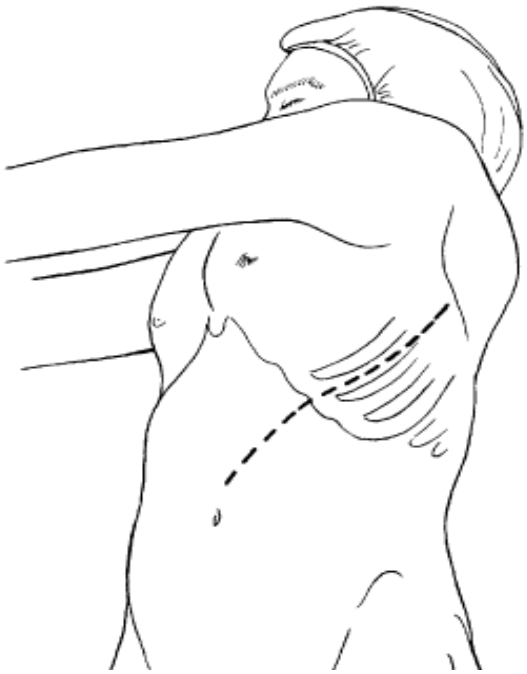
5- External iliac vessels

6- Frequently used for transplantation of the kidney into RIF

Incision made 2cm above the anterior superior iliac spine [ASIS] to just lateral to symphysis pubis. External oblique, internal oblique, transversus abdominis, and the transversalis fascia are divided in line with skin incision, after which retro peritoneal area is entered and the retro peritoneal fat and peritoneum are bluntly dissected upwards and medially.

If peritoneum is opened it is closed immediately. Ilio inguinal nerve is the inferior branch of 1st lumbar nerve and terminates in scrotum. Ilio hypo gastric nerve lies 2cm medial and 1cm inferior to the ASIS and follow a linear course, terminating 4cm lateral to the midline 5cm superior to pubic symphysis care to be given to preserve these nerves.

THORACO ABDOMINAL INCISION;



Converts pleural and peritoneal cavities into a single space.

Indications;

1- Lesion of lower esophagus

2- Lesion of cardia of stomach

3- Resection of right lobe of liver

4- Porto caval shunts

5- Large adherent spleen

6- Large upper abdominal masses

Indications of left thoraco abdominal incision;

1- Gastro esophageal junction lesion

2- Lesion of gastric cardia

3- Stomach lesion

4- Lesion of distal pancreas and spleen

5- Lesion of left kidney/ adrenal gland

6- Lesion of aorta

Indications of right thoraco abdominal incision;

Lesion of

1- Right hemi diaphragm

2- Upper esophagus

3- Liver

4- Hepatic triad

5- Vene cava

6- Proximal pancreas

7- Right kidney and adrenal

Patient placed in cork screw position, thorax placed laterally and abdomen tilted 45 degree. Abdomen opened by right sub costal incision and extended into the chest through 8^{th} inter costal space dividing the latissmus dorsi, serratus anterior and external oblique. Diaphragm can be opened by radial incision towards the esophageal and aortic hiatus or can be opened by a hemi elliptical incision 2 to 3 cm from lateral chest wall which preserves the phrenic nerve.

After completion of the operation chest tubes to drain the pleural cavity are passed around the ribs. Diaphragm repaired with 2 layers of

non-absorbable interrupted mattress suture. Costal arch stabilized by passing one or two heavy suture through the divided cartilaginous ends.

SEPARATE INFERIOR THORACIC [ANTERO LATERAL] INCISION;

Incision separate from abdominal incision made and it maintains integrity of costal margins but pain may occur from division of costal arch.

COMPLICATIONS OF LAPAROTOMY

Laparotomy complications are classified as;

1- Surgical wound complications
2- Complications of thermal regulation
3- Respiratory complications
4- Cardiac complications
5- Renal and urinary tract complications
6- Endocrine complications
7- Gastro intestinal tract complications
8- Neurological complications

Surgical wound complications;

Surgical wound complications are

1- Seroma
2- Haematoma

3- Acute wound failure[5]

4- Surgical site infection

Seroma;

Most benign complication. It is collection of lymphatic fluid, liquefied fat and serum under the incision. It is clear yellow and viscous fluid found in the subcutaneous plane. More common in mastectomy, axillary dissection and groin dissection. Seroma present as a swelling, discomfort or drainage of clear liquid from surgical wound. Seroma can be prevented by placement of a suction drain under the flaps, seroma that accumulates twice should be drained by opening the incision and drainage.

Hematoma;

It is an abnormal collection of blood[39] in a potential space and has potential to be infected. Formation is due to in adequate hemostasis, depletion of clotting factors or presence of coagulopathy.

Other causes are

1- Myeloproliferative disorders

2- Renal failure

3- Liver failure

4- Sepsis

5- Clotting factor deficiency

6- Medications

a. Aspirin

b. Clopidogrel

c. Triclopidine

d. Epitifibate

e. Abciximab

f. Unfractionated heparin

i. LMWH

ii. Vit- K antagonist

Hematoma present as an expanding un sighty swelling and pain in the area of surgical incision. On physical examination the hematoma appears as a localized soft swelling with purpled blue discoloration of overlying skin.

To prevent hematoma following measures are taken

1- Vit –K antagonist should be discontinued 4-5 days before surgery

2- UFH discontinued 4 hrs before surgery

3- LMWH discontinued 24hrs before surgery

4- Aspirin or clopidogrel discontinued 6-7 days before surgery

Acute wound failure;

Refers to wound dehiscence or burst abdomen and refers to post-operative separation of the abdominal musculo Aponeurosis layers. It a

Most dreaded complication which usually develops 7-10 days post operatively.

Factors associated with wound dehiscence;

1- Emergency surgery
2- Technical error in fascial closure
3- Intra-abdominal infection
4- Elevated Intra-abdominal pressure
5- Advanced age
6- Wound infection hematoma, seroma
7- Chronic steroid use
8- Obesity
9- Malnutrition
10- Previous wound dehiscence
11- Radio therapy / chemo therapy
12- Diabetes / uremia

Wound dehiscence[19] usually occurs without any warning but in 25% a sudden dramatic drainage of a relatively large volume of clear salmon colored fluid precede dehiscence. Technical errors in suturing which lead to wound dehiscence are[20]

1- Improper spacing of the suture
2- Inadequate depth of bite of fascia
3- Tension suturing
4- Poor abdominal relaxation during closure

5- Continuous suture in high risk patients

Management of wound dehiscence;

Depends upon the extend of fascial separation and presence of evisceration. Small dehiscence in the proximal aspect of upper midline incision 10- 12 days post operation can be managed conservatively by saline dressing and placing an abdominal binder. If evisceration is present intestine content is covered with sterile saline moistened towels and immediate exploration of the abdominal cavity done to rule out septic focus.

If fascia is strong and intact primary closure done.

If fascia is infected debridement done followed by any one of the procedure

1- Incision closed with retention suture

2- Absorbable mesh [polyglactin, polyglycolic acid] placed and wound closed, once granulation good SSG applied[40]. Later hernia develops which must be repaired[16]

3- Abdominal closure by component separation method

4- Incision left open or closed with a laparotomy closure device

5- Negative pressure wound dressing[41] is based on the concept of wound suction device consist of vacuum pump, open pore foam,

canister with connecting tubing and semi occlusive dressing. Appling suction of 125mmhg is ideal and it assist in reduction and changes in bacterial burden changes in biochemistry and system responses and acceleration of wound healthy.

Surgical Site Infection [SSI, Wound infection]

SSI represent a risk factor for the development of incisional hernia. Represent 40% of hospital acquired infection[42]. Wounds are categorized into 3 general categories-

1. Superficial incisional
2. Deep incisional
3. Organ specific

Superficial incisional;

1. Infection < 30 days after surgery along the skin and subcutaneous plane with 2. Purulent discharge or erythema, pus or local edema.

Deep incisional;

1. Infection < 30 days after surgery with no implant and soft tissue involvement.
2. Infection < 1 yr after surgery with an implant with
3. Purulent discharge,

4. Abscess or symptom of pain fever and tenderness leading to wound dehiscence

Organ specific;

1. Infection < 30 days after surgery with no implant and soft tissue involvement.

2. Infection < 1 yr after surgery with an implant

3. Purulent discharge from drain placed in the organ

4. Cultured organism from material aspirated from organ space

5. Abscess on radiological surgery

Most common source of these microorganism are from the patient endogenous flora occasionally the source is exogenous when a break in the surgical sterile technique occurs thus allowing contamination from surgical team.

Gram positive cocci account for half of the infections – *staphylococcus aureus* being the most common. Others include *coagulase negative staphylococcus* and *entero coccus spp.*\ Staphylococcus aureus that has acquired resistance to methicillin [MRSA] is classified as Hospital acquired and Community acquired MRSA. Hospital acquired **MRSA** are susceptible to vancomycin, teicoplanin and sulfa methaxazole. Newer organisms are **VISA**

[Vancomycin Intermediate Resistant Staphylococcus aureus] and **VRSA** [Vancomycin Resistant Staphylococcus Aureus][43] 1/3rd of SSI are due to gram negative bacilli[44] where GIT operation are performed such as

Escheriria coli

Pseudomonas aeruginosa

Enterobacter spp

SURGICAL WOUNDS ARE CLASSIFIED AS

1- Clean

2- Clean contaminated

3- Contaminated

4- Dirty

In NATIONAL NOSOCOMIAL INFECTION SURVEILLANCE SYSTEM[45] the risk of patient is stratified in accordance with three important factors

1- Wound classification [contaminated or dirty wound]

2- Longer duration of surgery

3- Medical characteristics of persons determined by ASA [American Society of Anesthesiology Score of III,IV and V

SSI most commonly occur 5 to 6days post operatively and 80 to 90 % occur within 30 days of surgery According to JOINT COMMISION

[TJC] a wound is considered infected if Drainage of gross pus from wound present

1- Wound opens spontaneously and drains purulent fluid
2- Wound drains fluid that is culture positive to bacteria
3- Surgeon notes erythema or drainage and opens the wound

Prevention;

1- Stop smoking one month before surgery
2- Reduce obesity
3- Wean of corticosteroids
4- Preparation of bowel
5- Hair removal by clipping immediate before surgery and skin pepped with antiseptic agent
6- Antibiotics prophylaxis and for dirty wound therapeutic dose of antibiotics with either first generation or second generation cephalosporine[46]
7- Prophylaxis given 30 mins pre operatively and intra operatively 4 hrs apart and along with 2 doses post operatively will be effective.
8- Personal hygiene
9- Careful handling of tissues
10- Meticulous dissection, hemostasis and debridement
11- Control of intraluminal contents

12- Preservation of blood supply to operated site

13- Elimination of any foreign body

14- Strict asepsis

15- Through irrigation and drainage of pus with warm saline

Treatment of SSI depend on depth of infection. For superficial and deep SSI skin staples removed and purulent material evacuated. If wide spread cellulitis or infection then IV antibiotics with broad spectrum given empirically and followed by a pus culture and sensitivity and wound targeted with appropriate antibiotics. Most post-operative infections are treated with healing by secondary infection.

RESPIRATORY complications;

Most common respiratory complications following surgery are

1. Hypoxemia
2. Hypercapnia
3. Aspiration

Post-operative hypoxia;

Is defined as an condition in which oxygen saturation is less than 90%. It manifest as shortness of breath, agitation, upper airway obstruction or as cyanosis. Hypoxia occurs due to

1. Residual effect of general anesthesia

2. Secretion or wound hematoma after neck surgery
3. Laryngeal edema from traumatic tracheal intubation
4. Recurrent laryngeal nerve palsy
5. Hypoventilation
6. Atelectasis
7. Pneumonia
8. Pneumonitis
9. Pulmonary edema
10. Pulmonary embolism

Loss of FUNCTIONAL RESIDUAL CAPACITY may be due to

1. Abdominal distention
2. Painful upper abdominal incision
3. Obesity
4. Strong smoking

Prevention of respiratory complications

1. Cessation of smoking one week before or at least 48 hrs before surgery

2. Adequate pain control
3. Use of EPIDURAL catheter
4. Spirometry for high risk patients

FEV1 [Forced Expiratory Volume in one second] is most important. FEV1 higher than 2 liters will probably not have serious pulmonary complications In Patients with PAO2 < 60mmhg and PACO2 > 45mmhgmist be anticipated for peri operative morbidity

Treatment;

1. 15l/min of O2
2. Head tilt, chin lift or jaw thrust
3. Suction of any secretion
4. If neck hematoma it is evacuated immediately under LA or GA
5. Antibiotics
6. Chest physiotherapy
7. Bronchodilators
8. Incentive spirometry and cough while applying counter pressure with a pillow at the abdominal incision site is most helpful
9. Chlorhexidine rinse
10. Sucralfate instead of PPI

RESPIRATOR FAILURE;

Two types are present

TYPE1FAILURE;

Reduced PaO2

Decreased PaCO2

Due to abnormal gas exchange at the alveolar level

TYPE 2 FAILURE;

Reduced PaO2

Increased PaCO2

Due to excessive narcotics and ARDS

ATELECTASIS;

Is a condition in which periphery alveoli collapse and pulmonary shunt occurs. Secretion accumulate and become secondarily infected to form pneumonia. Most common respiratory complication following surgery. Most common cause of post operative fever in first 24 hours. Present with malaise, fever, diminished breath sounds.

PNEUMONIA;

Most common nosocomial infection. Present with confusion, thick secretion on coughing with chest X ray showing infiltrates. Culture is taken by blind tracheo bronchial aspiration or by bronco alveolar lavage.

Predisposing risk factors are;

1. Depressed immunity
2. Concominant disease
3. Poor nutrition
4. Increased length of hospital stay
5. Smoking

6. Increased age
7. Uremia
8. Alcohol consumption
9. Presence of Endo Tracheal Tube
10. Presence of Naso Gastric Tube
11. On therapeutic PPI

HOSPITAL ACQUIRED PNEUMONIA;

Classified as early [<5days] and no prior antibiotics and early and recent antibiotics and those with late hospital acquired [>5days] types. Most common organism in the early and no prior antibiotics are

STREPYOCOCCUS PNEUMONIA

HAEMOPHILUS INFLUENSA

ENTEROBACTERIACEAE

STAPHYLOCOCCUS AUREUS

Where as in the latter group *GRAM NEGATIVE BACILLI* is also involved

Treatment;

Empirical antibiotics

ASPIRATION PNEUMONITIS AND ASPIRATION PNEUMONIA;

MENDELSON syndrome [aspiration pneumonitis] describes acute lung injury resulting due to regurgitation of gastric contents[55]. Aspiration pneumonia result from inhalation of oropharygeal secretion that colonize by pathogenic bacteria. Severity increases with increased volume and decreased Ph.

Predisposing factors;

1. Impaired esophageal sphinters
2. Impaired laryngeal reflex
3. Altered gastro intestinal motility
4. Absence of pre-operative fasting
5. Altered consciousness
6. Patient on NGT
7. Diabetics due to gastroparesis and gastric stasis

Prevention;

1. Fasting 6 hrs after a night meal and 4 hrs after clear fluids
2. Pre oxygenation with O2 without lung inflation
3. Intubation with cricoid pressure during rapid induction sequence
4. Encourage post-operative ambulation

Investigation;

CXR – If aspirated O2 given and CXR taken. CXR shows diffuse interstitial pattern seen bilaterally described as bilateral fluffy infiltrates

Treatment;

1. Oxygen
2. Empirical antibiotics with coverage against GRAM negative organisms
3. Intubation

PULMONARY OEDEMA;

Is accumulation of fluid in the alveoli. May be due to prolonged supine position or fluid overload. Present with wedge and right sided heart pressure. Auscultation reveals crackles and occasionally rales.

Predisposing factors;

1. Cardiac disease
2. History of massive fluid administration

Treatment;

1. Fluid restriction
2. Aggressive diuretics
3. Oxygen via face mask

ACUTE LUNG INJURY [ALI];

ALT is associated with hypo-oxygenation because of patho physiologic inflammatory response leading to accumulation of fluid in the alveoli.

Associated with PaO2 / FIO2 [fraction of inspired oxygen] ratio of less than 300. And a wedge pressure of 18mmhg. Patients have increased work of breathing, tachypnea and dyspnea.

ACUTE RESPIRATORY DISTRESS SYNDROME [ARDS];

ARDS is associated with hypo-oxygenation because of patho physiologic inflammatory response leading to accumulation of fluid in the alveoli. Associated with PaO2 / FIO2 of less than 200mmhg and wedge pressure of 18mmhg. Patients have increased work of breathing, tachypnea and dyspnea.

Management of ALT and ARDS;

1. If impending respiratory failure immediate intubation and careful intra venous fluid management

2. FIO2 initially placed to 100% and then weaned to 60%
3. Addition of positive end expiratory pressure
4. Tidal volume need to be 6 to 8ml / kg
5. Peak pressure kept at 35cm H2O
6. Inspiratory to expiratory ratio is set at 1 : 2
7. Heavy sedation and pharmacological paralysis[54]

PULMONARY EMBOLISM [PE] AND DEEP VEIN THROMBOSIS [DVT];

PE originates from an existing DVT in the legs and the ileo femoral venous system represent the site from which clinically most PE originate[56,57,58]. Massive PE present with hypotension with or with out shock.

Investigation;

1. CXR is not useful and used to diagnosis other causes
2. Helical CT
3. D-dimer
4. Venous duplex USG
5. Pulmonary angiography
6. ECHO- shows right ventricle dysfunction hypokinesia and dilatation

Treatment;

If stable – anti coagulation

If unstable – anti coagulation and Venous Ultra Sound [VUS] and DVT are preformed, if positive then thrombolytic therapy and if negative pulmonary angiography done.

1. Heparin 10 IU/ kg followed by 1000 units / hr
2. Fondaparinux

3. VIT-K Antagonists

4. LMWH

a. Enoxaparin 1.5 mg / kg /day

b. Dalteparin 10000 to 18000 units per day

CARDIOVASCULAR COMPLICATIONS;

Common complication are[59]

1. Hypotension
2. Hypertension
3. Myocardial ischemia and infarction
4. Arrhythmias
5. Cardiogenic shock
6. Heart failure

Hypotension;

Hypotension due to

1. Inadequate fluid replacement
2. Vaso dilatation from sub arachnoid and epidural anesthesia
3. Surgical bleeding
4. Myocardial ischemia
5. Heart failure
6. Pulmonary embolism
7. Tension pneumothorax
8. Anaphylaxis

Patients have cold clammy extremities with increased heart rate, low urine output<0.5ml/kg/hr and low CVP.

Treatment;

Crystalloids or colloid

HYPERTENSION;

Occurs in 25% of patients undergoing surgery. More common in patients undergoing intra abdominal, thoracic and cardiovascular procedure.

Causes;

1. Pain
2. Hypothermia[47]
3. Hypoxia
4. Fluid overload

Hypertensive patients undergoing elective surgery must continue their medication up to day of surgery. If clonidine then should be switched to clonidine patch for atleast 3 days before surgery. If can't take oral then IV beta blocker, ACE Inhibitors, Calcium channel blocker and diuretics are given if not clonidine trans dermal patch given.

Hypertensive crisis;

Severe elevation of BP associated with organ dysfunction and management by a drug with rapid onset, short halflife and few autonomic side effect is essential. Most commonly used drugs are

1. Vasodilators

a. Nitroprusside
b. Nitriglycerine
2. Beta blockers
a. Labetalol
b. Esmolol
3. ACE Inhibitors
a. Enalaprilat
4. Calcium channel blocker
a. Nicardipine

It is crucial not to decrease BP > 25% to avoid ischemic stroke and hypoperfusion.

MYOCARDIAL ISCHEMIA AND INFARCTION;

Patients with previous cardiac problem are at risk and patients present with retro sternal pain with radiation. Risk of MI is high in first 48hrs after surgery. Operation with in 3 months of an infarction have 8-15% re infarction rate and at 3 to 6 months post MI the risk rate in 3.5%.[60]

Risk factors;

1. Patients undergoing vascular, thoracic, orthopedic and upper abdominal surgery

2. Smoking
3. Family history of MI
4. Adverse lipid profile
5. Diabetes
6. Hypertension

Investigation;

1. ECG- show ST elevation [STEMI] in continuous leads or new left Bundle Branch Block or NSTEMI

2. CARDIAC SPECIFIC TROPONIN I and T

- Detected with in 2Hrs or may be delayed up to 8 to 12 Hrs
- Timing of elevation of cardiac troponins are similar to CK-MB but cTns persist for up to 5 to 14 days
- TnI- >1ng/ml is specific and remain elevated up to 7 to 10 days
- TnT- remain elevated up to 10 -14 days

3. MB Iso enzyme of creatinine kinase [CK-MB]

- Short half life

Treatment;

1. O2

2. Glyceryl Tri Nitrate [GTN] or Nitroglycerin
3. Morphine
4. Aspirin 160 to 325mg
5. Beta blocker oral or IV to maintain heart rate of <70 /min
6. Calcium antagonist
7. ACE Inhibitors
8. Systemic Heparin

ARRHYTHMIAS;

More likely in patient with structural heart disease. Arrhythmias cause hypotension and ischemia. Patient present with palpitation, chest pain, shortness of breath, dizziness, loss of consciousness, cardiac ischemia and hypotension[62].

Risk factors;

Increasing age

History of heart failure

Types;

Tachyarrythymia;

1. Supra ventricular tachycardia [sinus, atrial and nodal]
2. Ventricular tachycardia
3. Bradyarrythymia;

Supra ventricular tachycardia [sinus, atrial and nodal];

Causes;

1. Anxiety
2. Anemia
3. Fever
4. Pain
5. MI
6. Hypovolumia
7. Sepsis
8. Hypoxia
9. Heart failure
10. Thyrotoxicosis
11. Pheochromocytoma

Treatment;

If unstable- cardio version

If stable-

1. Amiodarone
2. Beta blocker [esmolol]- first line
3. Calcium channel blocker
4. digoxin

If normal rate not achievable then anti coagulation given to the patient with atrial fibrillation for greater than 48hrs.

Paroxysmal supra ventricular tachycardia;

1. adenosine
2. amiodarone
3. calcium channel blocker
4. digoxin

Ventricular tachycardia;

1. lidocaine
2. procainamide
3. amiodarone

Sinus bradycardia;

Causes;

1. normal in athletes
2. hypoxia
3. pre-operative beta blocker
4. digoxin
5. increased ICP

If heart rate 40 or <40 glycopyrrolate 0.2 to 0.4mg or atropine 0.6mg is given as IV.

CARIOGENIC SHOCK;

It is substantial reduction in cardiac output resulting in hypoperfusion. Is lethal in 75%

Treatment;

1. mechanical ventilation
2. aortic balloon pumps
3. CABG
4. Cardiac transplant

HEART FAILURE;

Is a clinical syndrome characterized by any structural or functional cardic disorder that impair the ability of the ventricle to fill or eject blood[63]. Heart failure is greatest immediately and after surgery in first 24 to 48Hrs. heart failure present with tachycardia, narrow pulse pressure, increased JVP, peripheral edema and rales.

Risk factors;

1. CAD
2. HT
3. Increasing age
4. Volume overload
5. Sepsis
6. Pulmonary embolism

CXR shows cardiomegaly, pulmonary edema and pleural effusion

Treatment;

Is directed at optimizing

1. Preload – nitrates reduce preload
2. Afterload –ACE Inhibitors reduce afterload
3. Myocardial contractility – selective or non-selective beta blocker[64]
4. Diuretics

In end stage inotropes are used

RENAL COMPLICATIONS;

Renal failure;

One fourth of patients have renal failure and is associated with high mortality.

Risk factors

1. Known chronic renal disease
2. Diabetes
3. Liver failure
4. Peripheral vascular disease
5. Cardiac failure

Types of renal failure

Pre renal causes;

1. Hypotension
2. Hypovolemia
3. Sepsis
4. Dehydration

Renal causes;

1. Myoglobinuria
2. Nephrotoxic drugs

a. Diuretics

b. Gentamycin

c. NSAIDS

Post renal;

1. Ureteric injury
2. Blocked uretheral catheter

Treatment;

If urine output < 0.5ml / kg / hour for 6 hrs

1. Check catheter
2. Correct electrolytes
3. Stop nephrotoxic drugs
4. For hyperkalemia

a. Insulin with glucose

b. Beta2 Agonist

c. Calcium gluconate

If serum creatine > 1.5 times the base line or >25% aggressive treatment is needed.

URINARY RETENTION;

More common in pelvic, perineal, hernia surgery done under spinal anesthesia. Also common in low rectal surgery.

Prevention

1. Prophylactic catheterization if surgery lasts >3 hrs
2. Adequate pain relief[local anesthesia] to surgery site

URINARY INFECTION;

Most common acquired infection. More common in diabetics and immune compromised. Treatment is by giving antibiotics and hydration.[53]

GASTRO INTESTINAL COMPLICATIONS;

Main complications after abdominal surgery are

paralytic ileus

bleeding or abscess

anastomotic leak

Ileus;

Two types are there primary and secondary. Primary or post-operative ileus is one in which spontaneous resolution occur in 2 to 4 days[69]. Secondary or adynamic or paralytic ileus is one in which there is no spontaneous resolution. Ileus present with nausea and vomiting, loss of appetite, bowel distention and absence of flatus. Return of function occurs in the following order. Small bowel > large bowel > stomach

Localized infection;

Abscess may present with persistent abdominal pain, focal tenderness and spiking fever. Blood investigation reveals neutrophilic leukocytosis and culture positive. USG and CT diagnose sub phrenic abscesses.

Early post-operative bowel obstruction;

Refer to obstruction within 30 days of surgery, occur due to adhesion[most common cause 92%] other causes being phlegmon, internal hernia and ischemia.

FEVER;

40% of post-operative patients develop pyrexia. Fever does not necessarily imply sepsis.

Cause of fever;

Day2 to 5- atelectasis

Day3 to 5- superficial and deep wound infection

Day5- chest infection, urinary tract infection, thrombophlebitis

>5days- wound infection, anastomotic leakage, abscess and intra cavity collection.

Investigation;

1. Full blood count
2. Urine culture and sensitivity
3. Sputum microscopy
4. Blood culture

Treatment; Individualized according to the cause

POST OPERATIVE DELERIUM [POD];

Occur in 5 to 15 % of the patients. Confusion may present as anxiety, incoherent speech, clouding of consciousness.

Risk factors;

1. Dementia
2. Use of narcotics
3. Benzodiazepines
4. Alcohol and alcohol withdrawal
5. Electrolyte abnormalities

Causes;

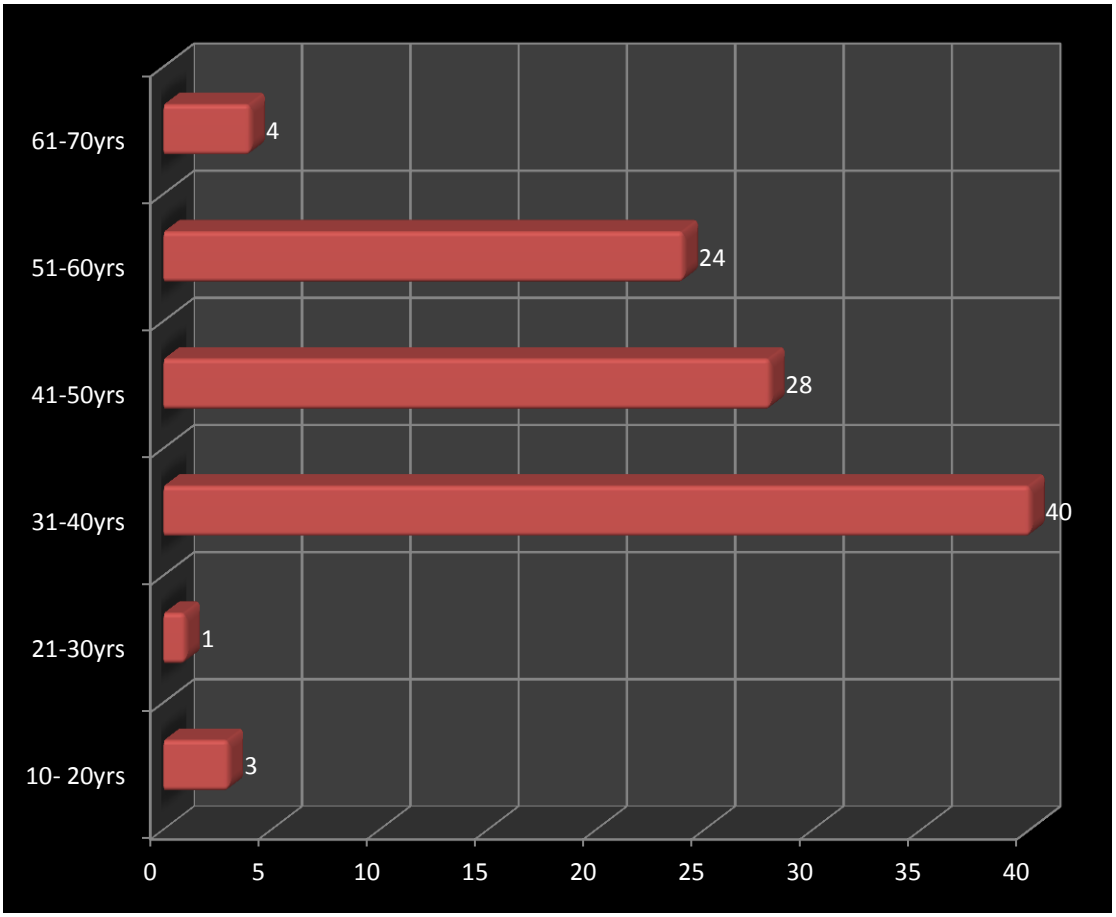
1. Renal failure
2. Hyponatremia
3. Electrolyte disturbance
4. Urinary tract infection
5. Hypoxia
6. Hypothyroid

Treatment;

Treatment of under lying cause and haloperidol

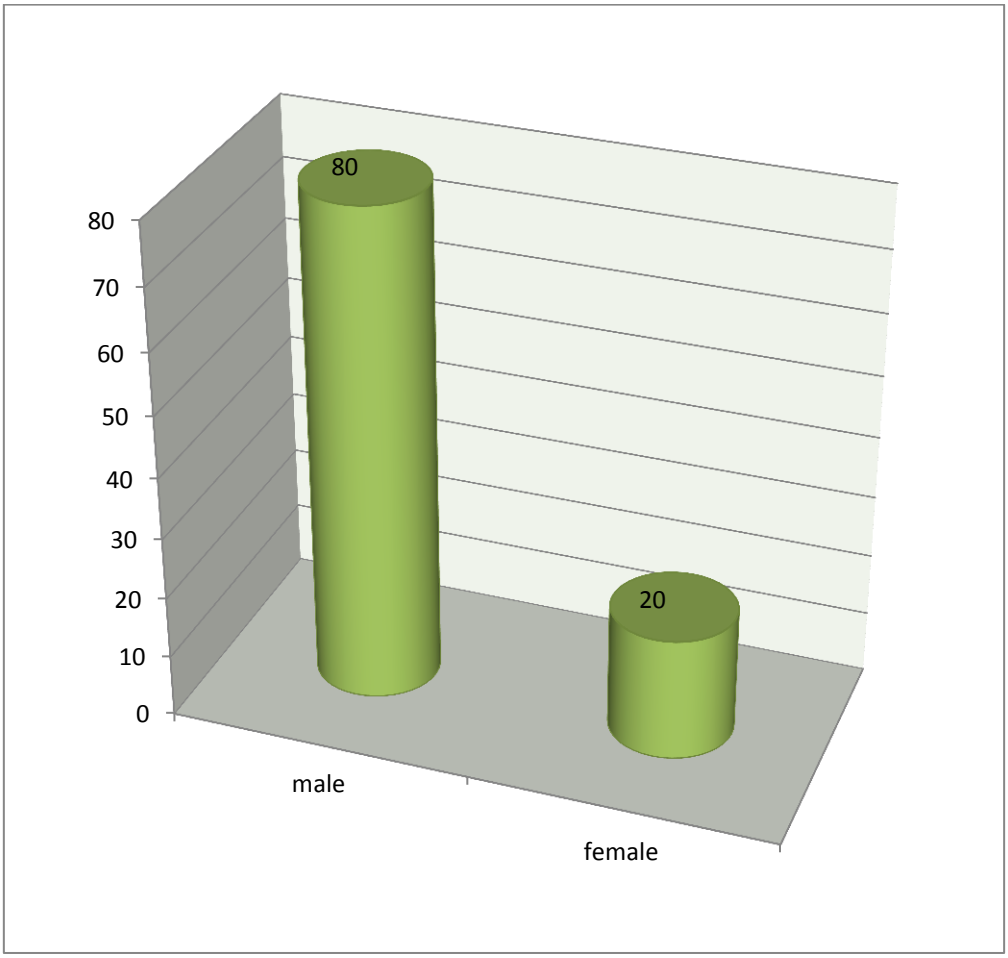
OBSERVATION AND RESULTS

Age incidence;



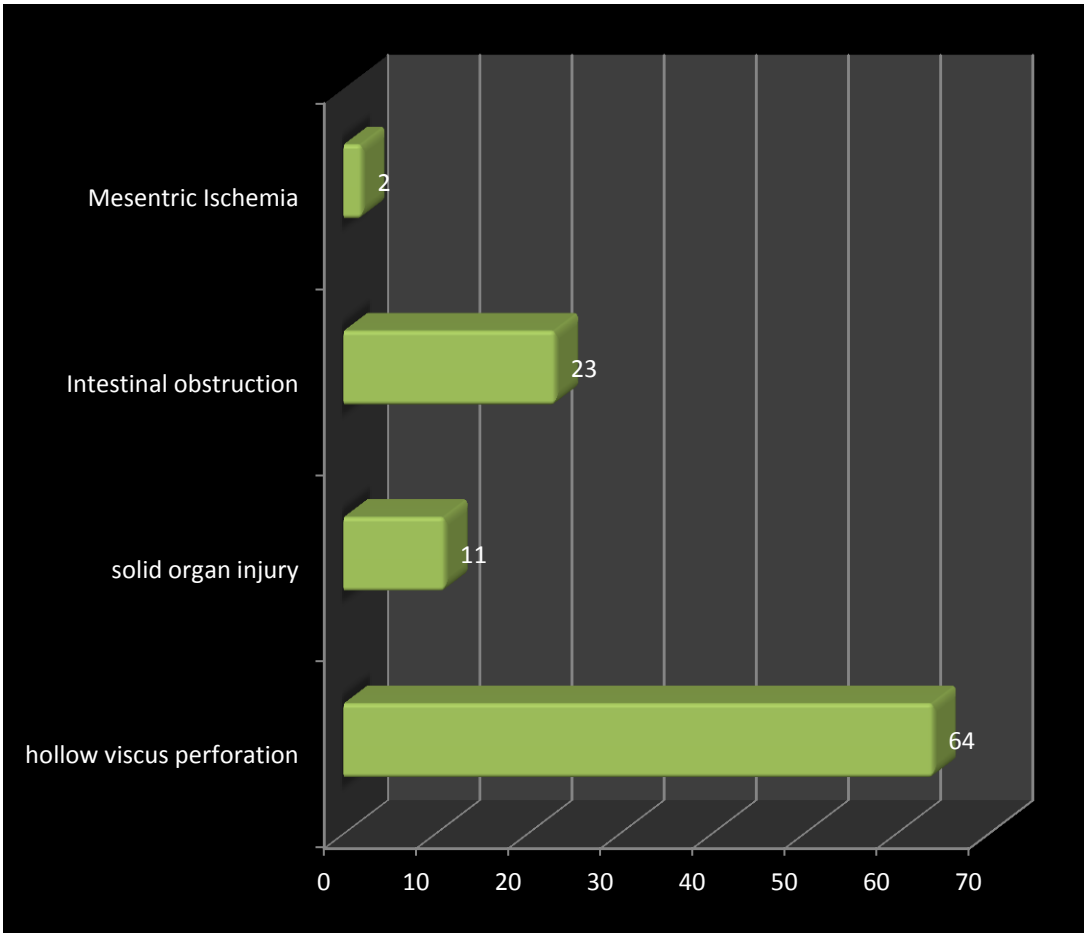
In our study most numbers of laparotomies where done between the 31st to 40 years to be followed by 41 to 50 years. Perforation was the most common in these cases where as malignant obstruction was more common in the 60 plus group.in 12 to 20 years and 20 to 30 years appendicular pathology was more common.

Sex incidence;



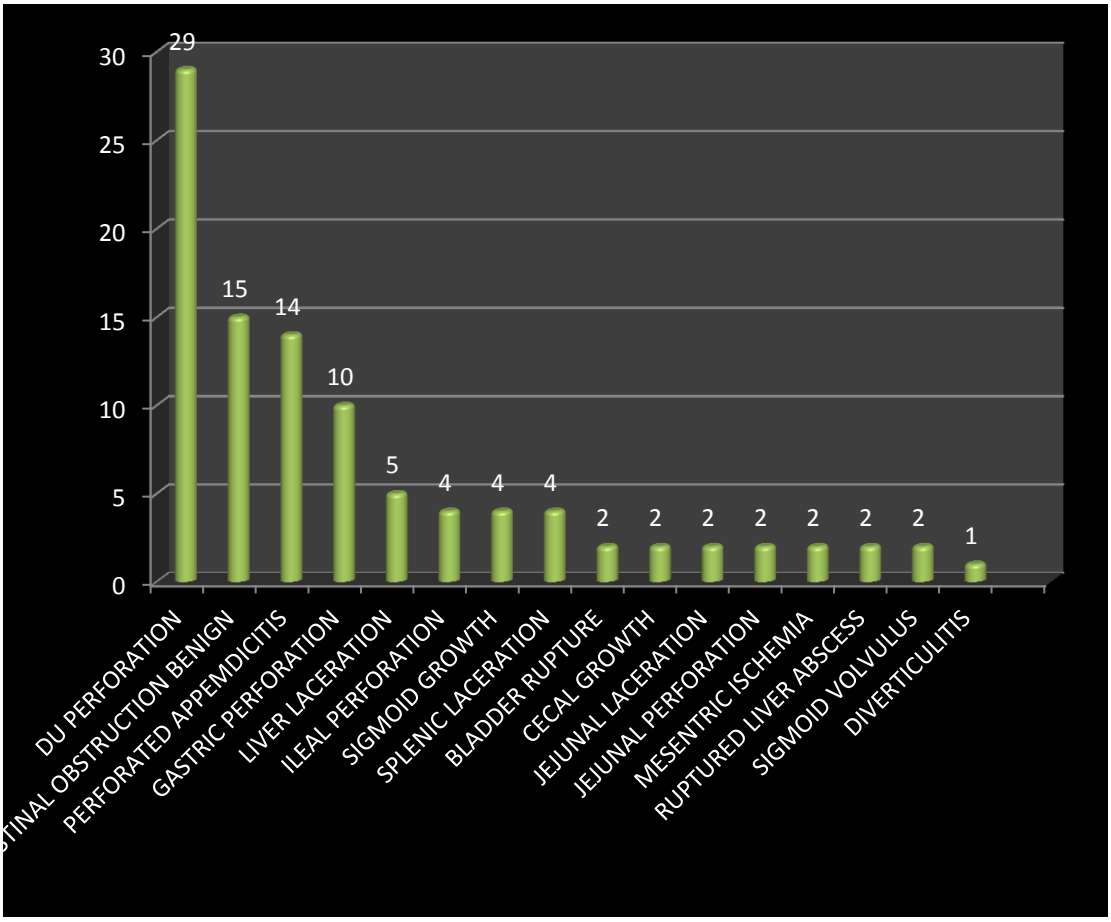
In our study of 100 emergency laparotomy cases the males outnumbered the females by a ratio of 4:1. Acute abdomen was more common in male due to the fact of consumption of alcohol and blunt injury due to their large outdoor activities. Duodenal perforation was more common in males where as in females intestinal obstruction was more common due to more prevalence of family planning surgery in them. Appendicular pathology followed next in frequency.

Incidence;



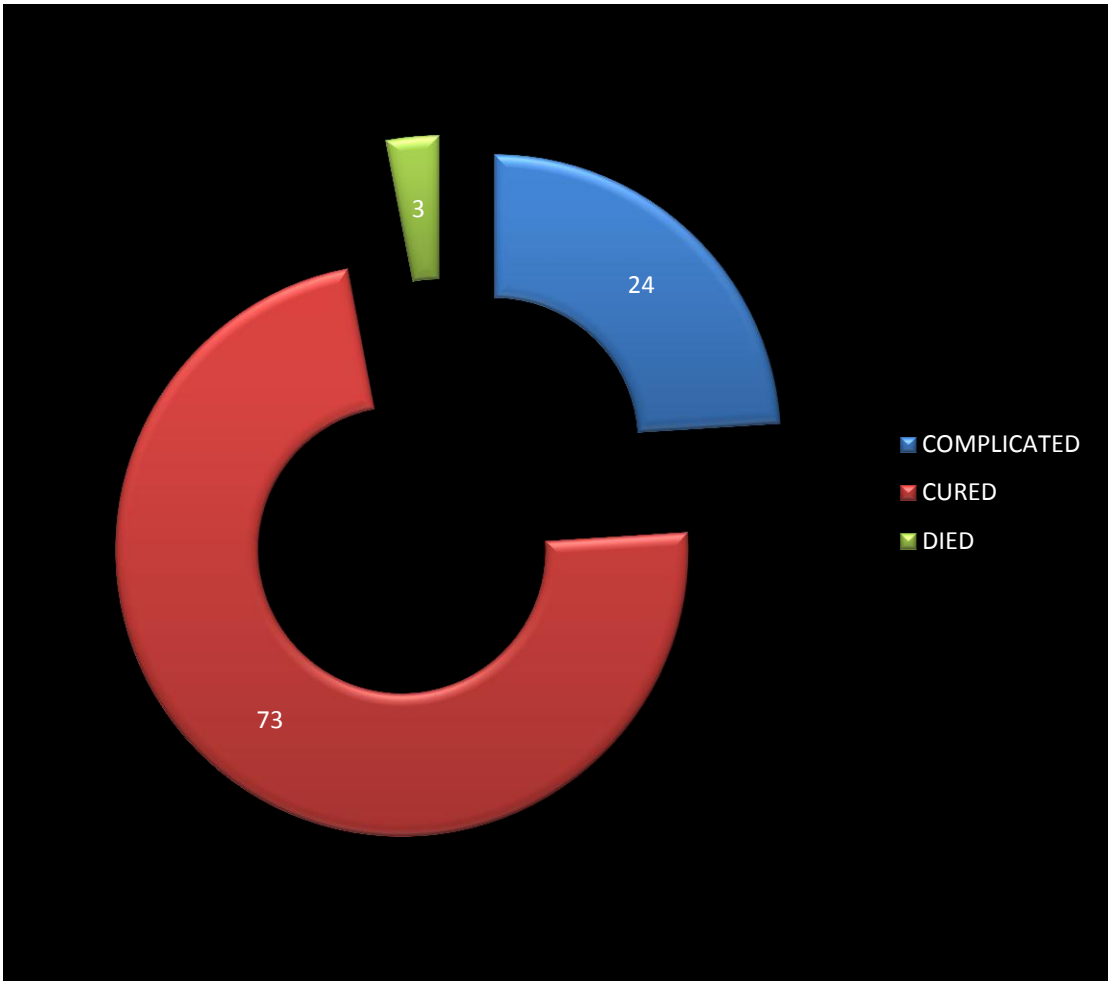
In our study of 100 cases hollow viscus perforation was the most common cause for acute abdomen and constituted 64%. Second most common cause was followed by intestinal obstruction [23%] to be followed with solid organ injury [11%]. Mesenteric ischemia constituted the least [2%] cause for emergency laparotomy in our set up.

Specific Etiology of acute abdomen;



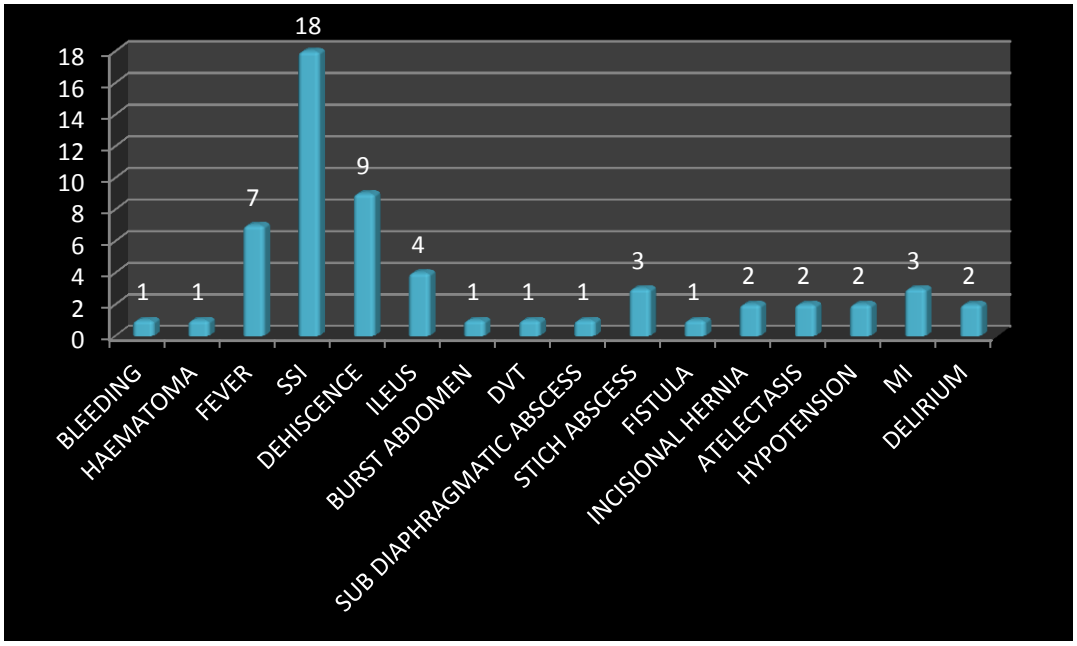
DU perforation was the most common cause of acute abdomen with an percentage of 29%. Intestinal obstruction was the second most common cause of acute abdomen needing emergency laparotomy with a percentage of 23% and frequency much higher in females. Perforated appendicitis constituted 14% which were explored by lower midline incision. Perforation of stomach constituted 10%, liver laceration constituted 5% and splenic laceration requiring splenectomy constituted 4%. In the remaining 15% emergency laparotomy was indicated for rare causes such as jejunal laceration / perforation, ileal perforation, bladder rupture, diverticulitis, sigmoid volvulus and mesenteric ischemia.

Outcome- complications;



In the study of 100 patients 73 patients underwent laparotomy for specific cause and got discharged without any complications and the remaining 27 had post-operative complications. Out of these 27 cases 3 expired postoperatively due to cardiovascular problem [MI]. 24 patients developed complications in the post-operative period which were dealt appropriately.

Complications;



SSI was the most common post-operative complication in our set up accounting for 66% of the cases. Apart from being the most common cause of post-operative complication SSI also pre disposed the patient to other complications such as fever, wound gaping and burst abdomen in the immediate post-operative period and incisional hernia in the late post-operative period. Wound dehiscence was the next most common with 33% and it was always predisposed by SSI.

Fever constituted with 26% and was present in most patient with SSI and in patient with sub diaphragmatic abscess. Stich abscess and myocardial ischemia were fourth in frequency with 22% and mortality was 100% in the myocardial ischemia group, stich abscess was explored after 3 months and Prolene was found to be responsible for the abscess.

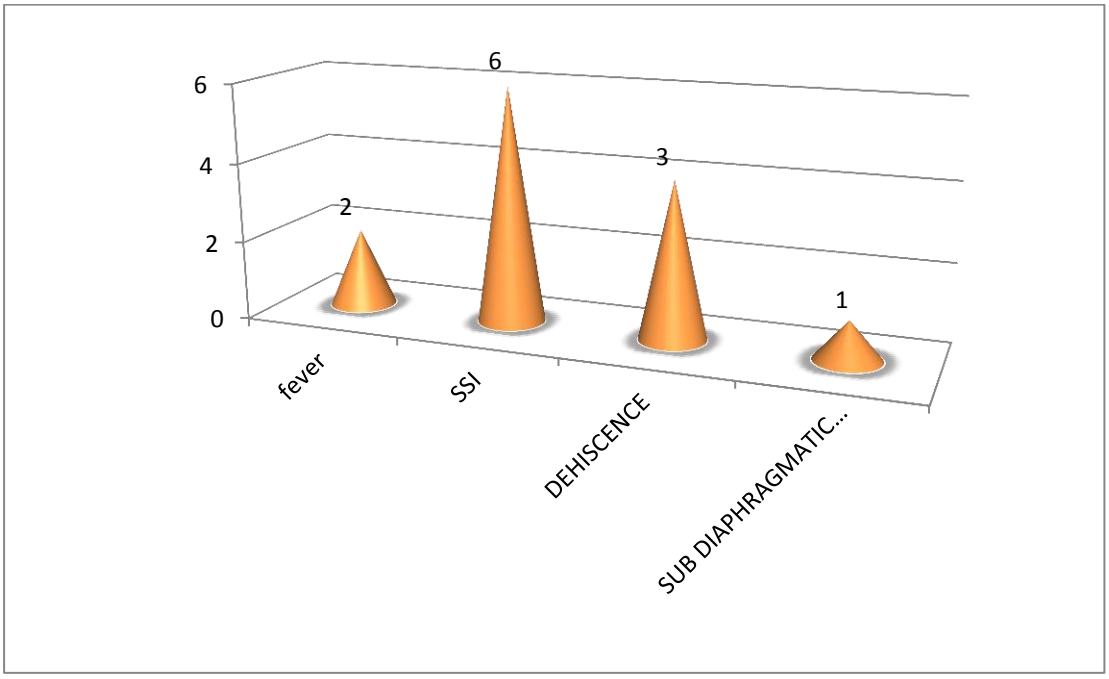
Paralytic ileus was present in 15% which responded to conservative management.[69]

Atelectasis was the most common pulmonary complication and delirium was the most common central nervous system complication. Hypotension was the second most common complication requiring immediate management in the post-operative period and the risk factor was pre-operative hypotension and epidural anesthesia.

Total percentage of complications exceeds 100% since a single complication predisposes to other related complications, for example SSI predisposes to wound dehiscence which in turn predisposes to burst abdomen or incisional hernia later. Similarly SSI may present with fever.

Bleeding from wound, hematoma, DVT, sub diaphragmatic abscess and burst abdomen were the least causes and two condition sub diaphragmatic abscess and burst abdomen were re explored. Burst abdomen was managed by placing warm saline packs and immediate re exploration at operation theatre.

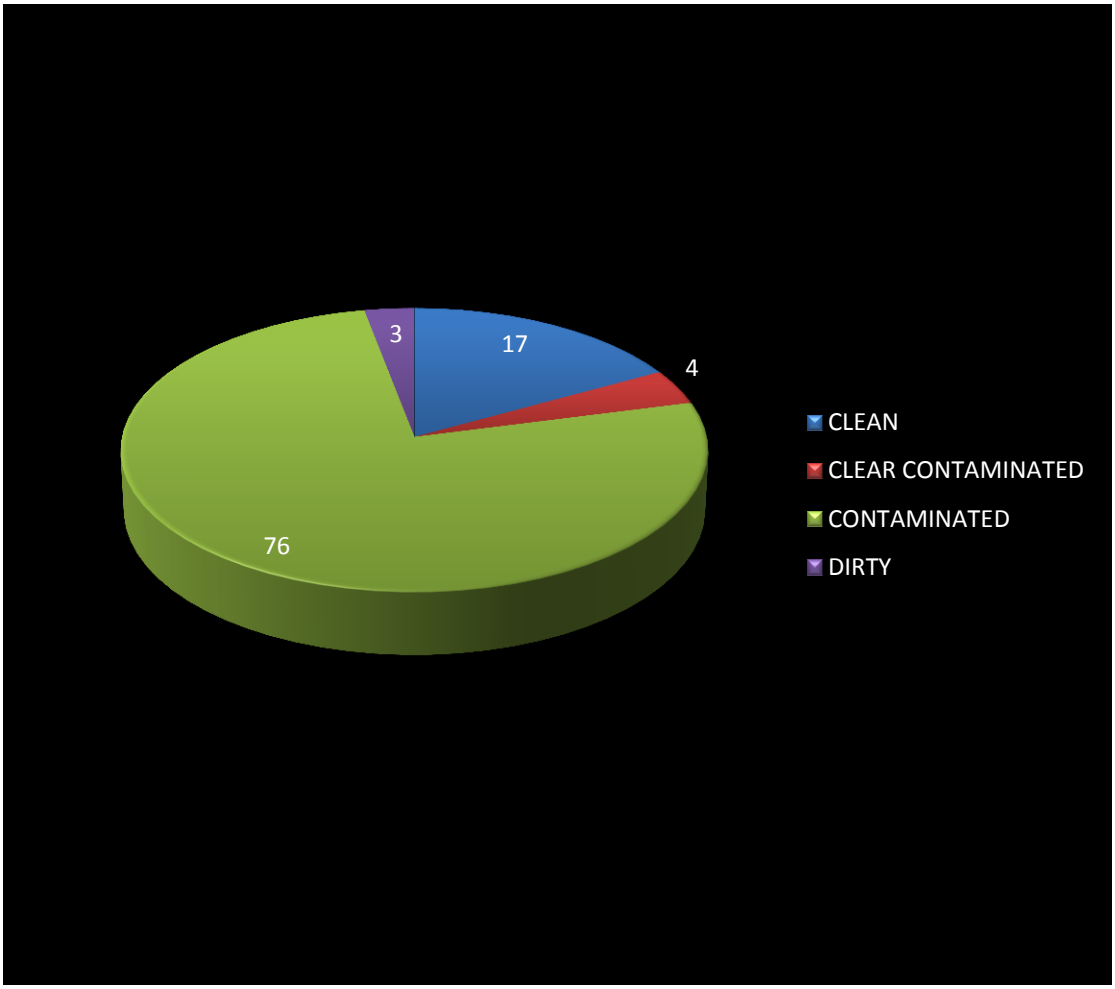
Duodenal and Gastric perforation surgery complications;



Out of the 39 duodenal and gastric perforations alcohol was the predominant predisposing factor and it also constituted for post-operative delirium. In the course of management 6 patient developed SSI, 3 developed dehiscence 2 developed fever, and 2 developed delirium due to alcohol withdrawal. 1 patient developed sub diaphragmatic abscess. Out of all these complications only sub diaphragmatic abscess required immediate laparotomy. Other complications were treated conservatively.

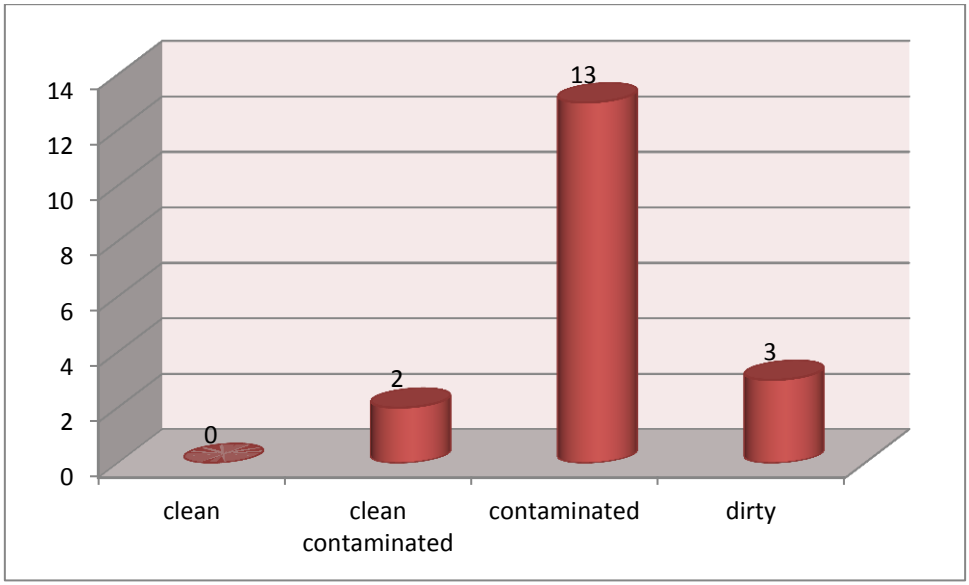
Sub diaphragmatic abscess was reopened and pus from both the right and left sub diaphragmatic space was drained with warm saline and antibiotic wash. Abdomen closed by placing two abdominal drain. Post operatively patient improved gradually and was discharged on day 21.

WOUND CLASSIFICATION;



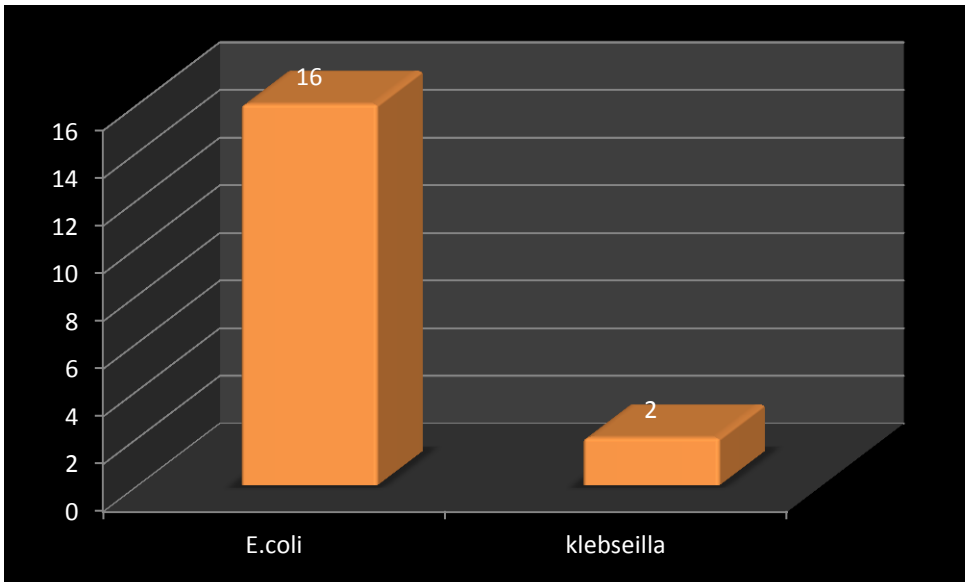
Out of 100 cases percentage of wound classification were as follows-17% of cases were clean, 4% were clear contaminated, 76 % were contaminated and 3% were dirty

Incidence of SSI in clean, clean contaminated, contaminated and dirty wound;



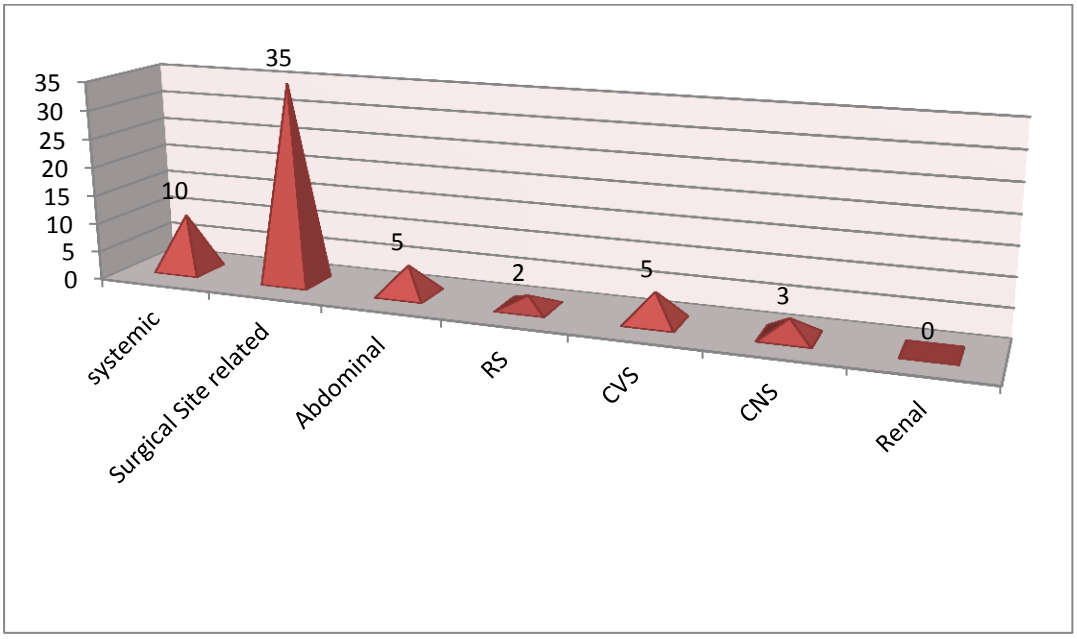
Incidence of SSI was nil [0%] in the clean wound, 2 [11.5%] in the clean contaminated type, 13 [72%] in contaminated type and 3 [16.5%] in dirty type.

Organism's in SSI;



Escherichia coli was present in 89% and klebseilla spp in 11%.

Incidence of complications system wise;

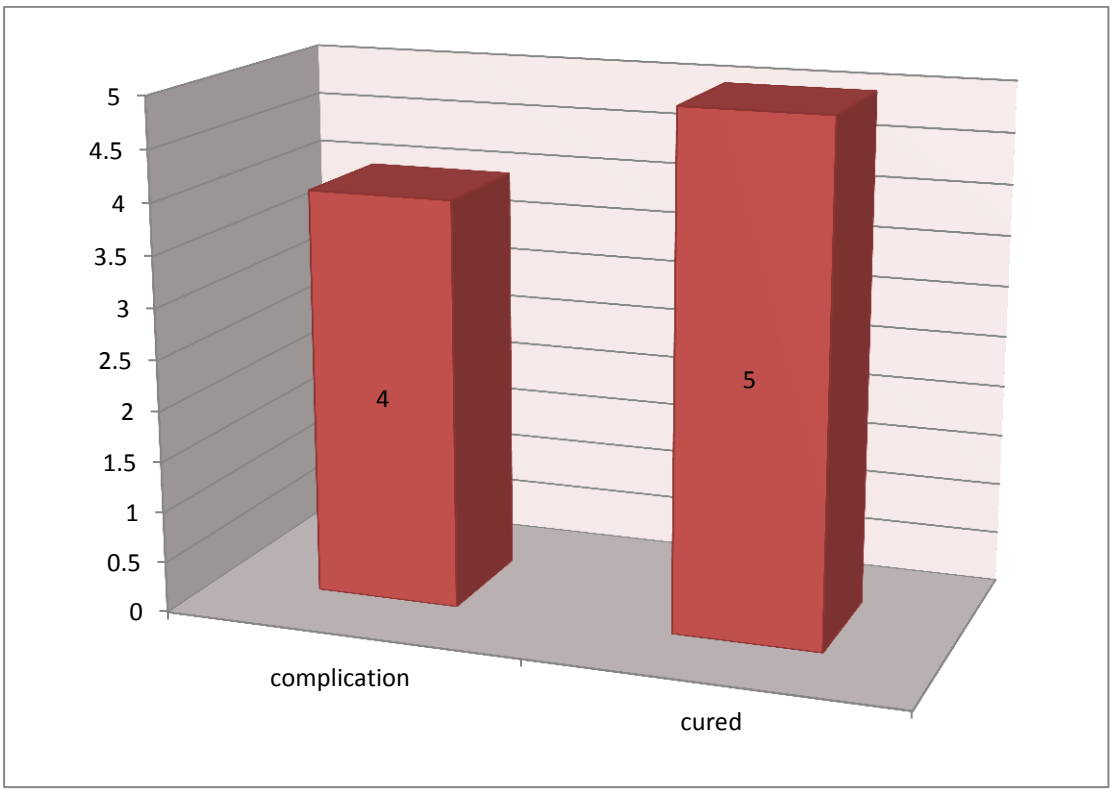


In our study surgical site related complications such as SSI, dehiscence burst abdomen, stich abscess, fistula and hernia constituted the major post-operative complications. Hematological and systemic causes constituted the next which included surgical site bleeding, hematoma, fever and DVT. Next in frequency was cardio vascular complications and abdominal complications. Abdominal complications included sub diaphragmatic abscess and post-operative ileus.

Cardiovascular complications included hypotension, arrthymia and myocardial ischemia. In our study myocardial ischemia in the post-operative period was associated with 100% mortality. Central nervous system complication which was present in our study was delirium. Most common association which was found in our study was between delirium tremons and post-operative delirium.

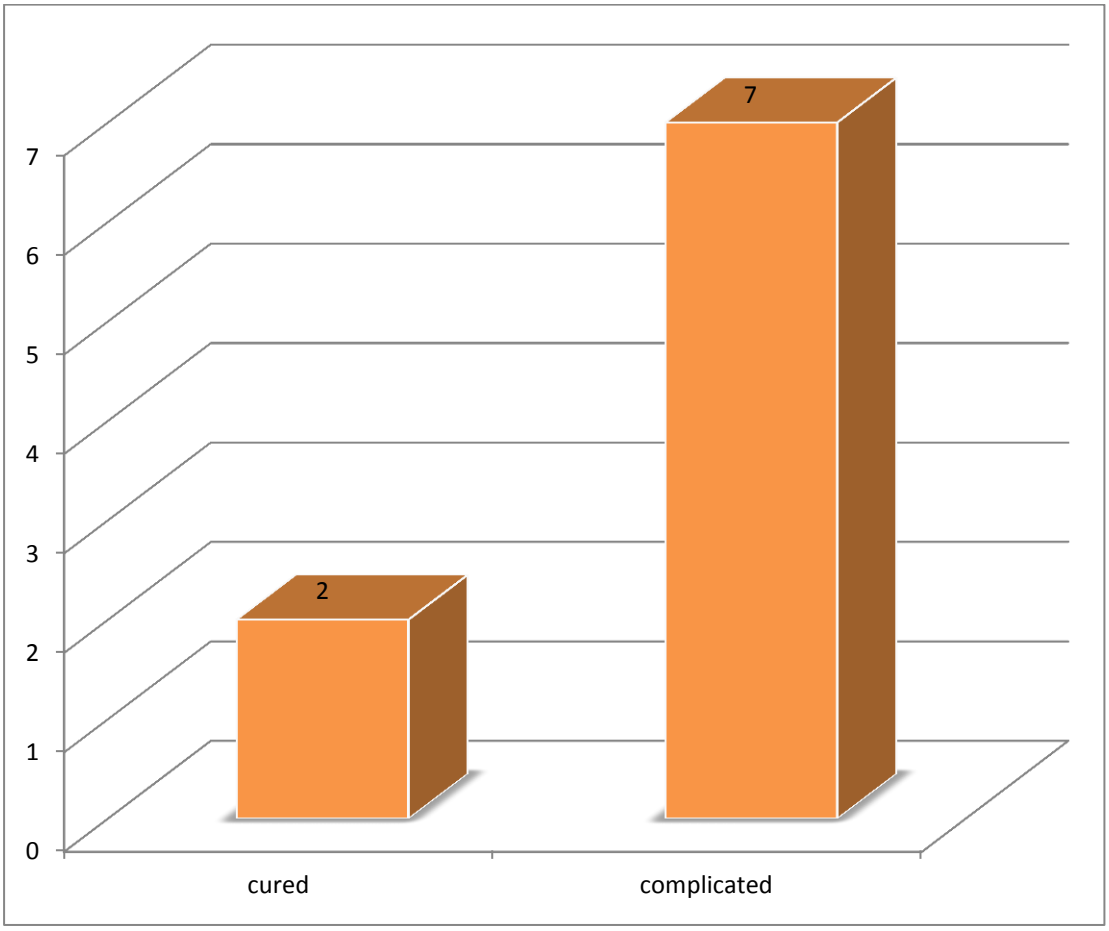
Respiratory complication atelectasis was present in 2 patients and was associated with upper abdominal surgery mostly involving the liver or spleen. Conservative treatment with bronchodilators, physiotherapy and cough with a pillow placed over the incision site cleared it.

Disease progress in patients with Hemoglobin < 9gram;



9% of patient's where of hemoglobin level less than 9 gram percent. Out of which 4 cured and 5 had complications in the post-operative period. More percent of cure in the anemia group is due to the fact that in blunt injury abdomen there is acute loss of blood which returns normal in the post-operative period after taking control of the hemorrhage and post-operative and intra operative blood transfusion.

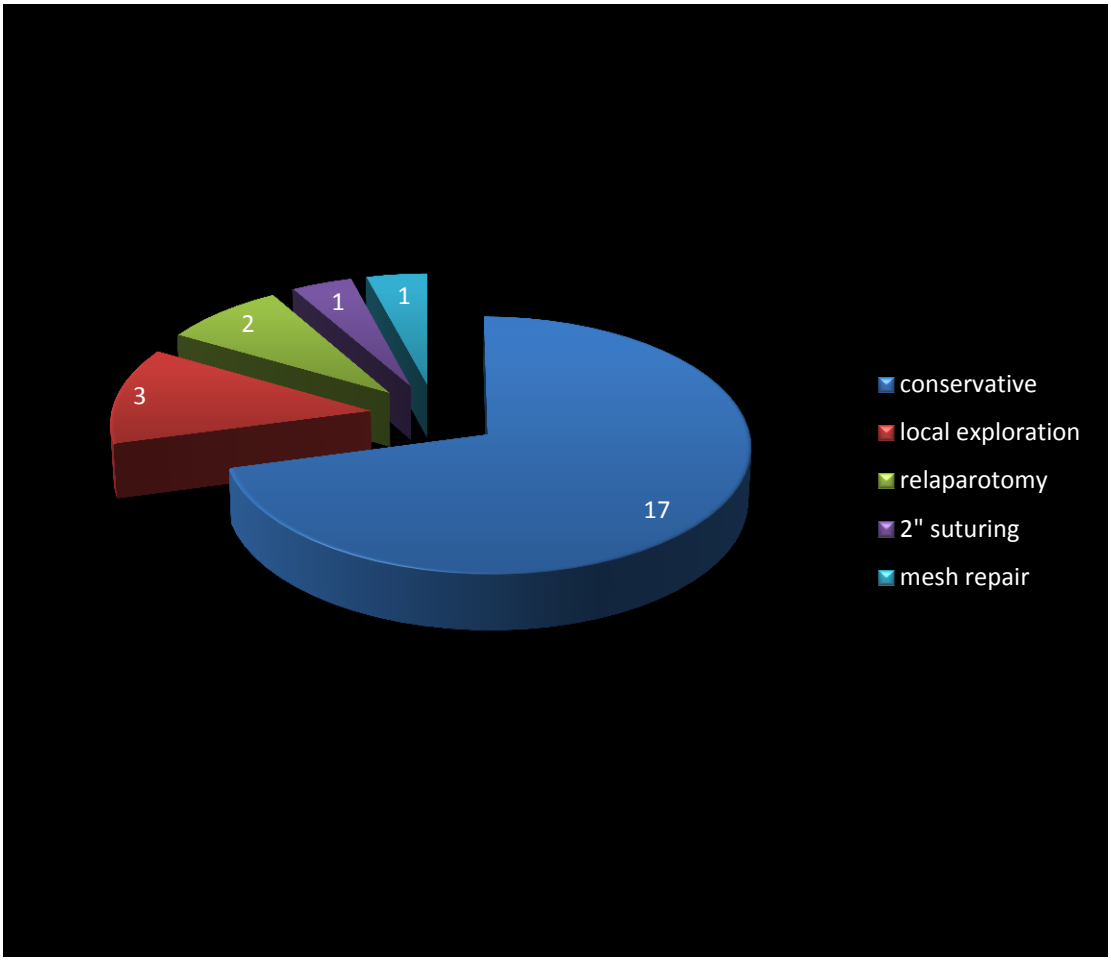
Relation of hypoalbuminemia with complications;



Out of 100 patients 9 patients had hypoalbuminemia out of which 2 got cured and remaining 7 patients had enormous complications such as SSI [6 out of 7patients], fever [2 out of 7patients], wound dehiscence [5 out of 7patients], ileus [3 out of 7], delirium [2 out of 7patients], sub diaphragmatic abscess [one patient], burst abdomen [one patient], stich abscess in one patient and incisional hernia in one patient.

Surgical site related complication were more affected in hypoalbuminemia than any other individual parameter. Correction of albumin with 20% albumin related to an earlier recovery and discharge.

Complication management;



Conservative	**17**
local exploration	**3**
Relaparotomy	**2**
2" suturing	**1**
mesh repair	**1**

In our study of 100 cases complication occurred in 27 patients out of which 3 died in the post operative period and the remaining patients

were subjected to treatment according to their complications. Conservative management proved ideal in 17[74%] patients and there was no need for further surgical management. In the remaining local exploration for stich abscess proved ideal and only in 2 cases emergency re laparotomy was indicated. There was no mortality in the re laparotomy group.

Secondary suturing and incisional hernia repair was done in for the remaining 2 cases. secondary suturing was done under local anesthesia and with 3’0 prolene. Mesh repair of the incision hernia was done after 6 months after improving the general condition and by placing a Vicryl-prolene mesh.

DISCUSSION

In our study of hundred laparotomies, laparotomy was done more common in the 31 to 40 years age group to be followed by 41 to 50 yrs group. Perforation of hollow viscus was the most common cause for laparotomy, where as in above 60yrs intestinal obstruction secondary to malignancy was relatively more common.

The sex ratio male: female of emergency laparotomy was found to be 4:1. Males outnumbered the females due to increased outdoor activities, smoking and alcohol. Duodenal perforation was more common in males. Over view of the causes for emergency laparotomy revealed 64% due to hollow viscus perforation next to follow was intestinal obstruction 23%, solid organ injury 11% and mesenteric ischemia with high mortality. (80-90%)[95]

Solid organ injury was found only in males in study and the intake of alcohol by males predisposes the patient to liver abscess rupture. According to cooper et al 8% of cases of acute abdomen have solid organ injury and 83% were due to blunt trauma.[96] Looking on the specific etiology of acute abdomen duodenal perforation was the single most common cause of acute abdomen in our study with 29%. Intestinal obstruction constituted 23% and to be followed with perforated appendicitis in 14%.

Gastric perforation constituted 10% for emergency laparotomy. Liver laceration following blunt injury abdomen with marked hypotension constituted 5%.ileal perforation, sigmoid growth and splenic laceration following blunt injury constituted 4% of cases respectively. Sigmoid growth was more common in age group greater than 60yrs.[77]

Other rare causes such as bladder rupture, ceacal growth, jejunal perforation and laceration, ruptured liver abscess, mesenteric ischemia and sigmoid volvulus constituted 2% of cases respectively. Diverticulitis was rare with one case requiring surgery emergently.

In our study 73% of patients got discharged without complications and 3% died due to post-operative complications and the remaining 24% of cases developed post-operative complications. Among the 24% of patients who developed complications SSI accounted for 66%. SSI also predisposed the patient to other complications such as wound dehiscence, burst abdomen and incisional hernia. Most common organism causing SSI was E.coli.

Wound dehiscence was present in 33% and it was always predisposed by SSI. Fever was present in 26%, stich abscess and MI constituted 22% with high mortality in post-operative MI. paralytic ileus was present in 15% which were treated conservatively. Atelectasis was the pulmonary complication seen in our set up under going upper abdominal surgery. In one case of Fistula the organism was again E.coli which responded to conservative management.

Delirium was seen in alcoholic patients undergoing emergency laparotomy in the 2nd or 3rd day. Bleeding from wound, hematoma, DVT, sub diaphragmatic abscess and burst abdomen were the least causes.

In our prospective study 76% was contaminated type, 17% clean type, 4% clean and 3% dirty. Incidence of SSI in clean wound was nil, 11.5% in clear contaminated, 16.5% in dirty,72% in contaminated type. As a whole Surgical Site related complication outnumbered other complications. Patients with hypoalbuminima had post-operative complications more of which interfered with wound healing resulting in gaping, burst abdomen and incisional hernia. Of the total complications excluding the death 17 patients were treated conservatively, 3 required local exploration under local anesthesia.2 patients required re laparotomy, secondary suturing in one patient and mesh repair were done for incisional hernia after 6 months of previous surgery.

CONCLUSION

- Acute abdomen was more common among 31 to 40 years group
- Male is to female ratio was 4:1
- Hollow viscus perforation was the most common cause for emergency laparotomy
- Duodenal perforation was the single most common cause for emergency laparotomy
- Diverticulitis was the least common cause for emergency laparotomy
- Post-operative complication rate was 27%
- Post-operative mortality was 3%
- SSI is the most post-operative complication
- E. coli was the most common cause for SSI
- Post-operative myocardial ischemia had higher mortality
- Contaminated wound was the most common type in emergency laparotomies
- Hypoalbuminemia results in post-operative wound complications

- 20% albumin in the post-operative period resulted in early wound healing and reduced hospital stay
- Post-operative complications can be managed conservatively in 74%
- Surgical management needed only in 26% of complications

BIBILIOGRAPHY

01. National Center for Health Statistics: National Hospital Discharge Survey, Series 13, No. 122. Detailed diagnoses and procedures. 1995.

02. Rees VL, Coller FA: Anatomic and clinical study of the transverse abdominal incision. Archives of surgery 1943;47:136–146.

03. Axer H, Keyserlingk DG, Prescher A: Collagen fibers in linea alba and rectus sheaths. I. General scheme and morphological aspects. J Surg Res 2001;96:127–134.

04. Nahai F, Brown RG, Vasconez L: Blood supply to the abdominal wall as related to planning abdominal incisions. Am Surg 1976;42:691–69.5

05. Klinge U, Prescher A, Klosterhalfen B, Schumpelick V: (Development and pathophysiology of abdominal wall defects). Chirurg 1997;68:293–303.

06. Guillou PJ, Hall TJ, Donaldson DR, Broughton AC, Brennan TG: Vertical abdominal incisions – a choice? Br J Surg 1980;67:395–399.

07. Lip: De dwarse en vertikale incisie van de bovenbuik bij galblaasoperaties. Thesis, Rotterdam, 1981

08. Kendall SW, Brennan TG, Guillou PJ: Suture length to wound length ratio and the integrity of midline and lateral paramedian incisions. Br J Surg 1991;78:705–707

09. Lacy PD, Burke PE, O'Regan M, Cross S, Sheehan SJ, Hehir D, Colgan MP, Moore DJ, Shanik GD: The comparison of type of incision for transperitoneal abdominal aortic surgery based on postoperative respiratory complications and morbidity. Eur J Vasc Surg 1994;8:52–55.

10. Donaldson DR, Hegarty JH, Brennan TG, Guillou PJ, Finan PJ, Hall TJ: The lateral paramedian incision – experience with 850 cases. Br J Surg 1982;69:630–632.

11. Greenall MJ, Evans M, Pollock AV: Midline or transverse laparotomy? A random controlled clinical trial. Part I: Influence on healing. Br J Surg 1980;67:188–190.

12. Pfannenstiel J: Über die Vorteile des suprasymphysären Fascienquerschnitts für die gynäkologischen Koeliotomien. Sammlung Klinischer Vorträge N.F. no. 268, Gynäkologie 1900;97:1735–1756.

13. Armstrong PJ, Burgess RW: Choice of incision and pain following gallbladder surgery. Br J Surg 1990;77:746–748.

14. Halasz NA, Calif T: Vertical vs horizontal laparotomies. Arch Surg 1964;88:911–914

15. Garcia-Valdecasas JC, Almenara R, Cabrer C, de Lacy AM, Sust M, Taura P, Fuster J, Grande L, Pera M, Sentis J, Visa J: Subcostal incision versus midline laparotomy in gallstone surgery: a prospective and randomized trial. Br J Surg 1988;75:473–475.

16. Israelsson LA, Jonsson T: Incisional hernia after midline laparotomy: a prospective study. Eur J Surg 1996;162:125–129.

17. Santora TA, Roslyn JJ: Incisional hernia. Surg Clin North Am 1993;73:557–570.

18. Eisner L, Harder F: (Incisional hernias). Chirurg 1997;68:304–309.

19. Waldhausen JH, Davies L: Pediatric postoperative abdominal wound dehiscence: transverse versus vertical incisions. J Am Coll Surg 2000;190:688–691.

20. Hodgson NC, Malthaner RA, Ostbye T: The search for an ideal method of abdominal fascial closure: a meta-analysis. Ann Surg 2000;231:436–442.

21. Mudge M, Hughes LE: Incisional hernia: a 10 year prospective study of incidence and attitudes. Br J Surg 1985;72:70–71.

22. Lord RS, Crozier JA, Snell J, Meek AC: Transverse abdominal incisions compared with midline incisions for elective infrarenal aortic reconstruction: predisposition to incisional hernia in patients with increased intraoperative blood loss. J Vasc Surg 1994;20:27–33.

23. Thompson JB, MacLean KF, Coller FA: Role of the transverse abdominal incision and early ambulation in the reduction of postoperative complications. Arch Surg 1949;59:1267–1277.

24. Blomstedt B, Welin-Berger T: Incisional hernias. A comparison between midline, oblique and transrectal incisions. Acta Chir Scand 1972;138:275–278.

25. Cox PJ, Ausobsky JR, Ellis H, Pollock AV: Towards no incisional hernias: lateral paramedian versus midline incisions. J R Soc Med 1986;79:711–712

26. Brennan TG, Jones NA, Guillou PJ: Lateral paramedian incision. Br J Surg 1987;74:736–737.

27. Ellis H, Coleridge-Smith PD, Joyce AD: Abdominal incisions—vertical or transverse? Postgrad Med J 1984;60:407–410.

28. Luijendijk RW, Hop WC, van den Tol MP, de Lange DC, Braaksma MM, JN IJ, Boelhouwer RU, de Vries BC, Salu MK, Wereldsma JC, Bruijninckx CM, Jeekel JA: comparison of suture repair with mesh repair for incisional hernia. N Engl J Med 2000;343:392–398.

29. Maylard AE: Br Med J 1907;2:895

30. Johnson B, Sharp R, Thursby P: Incisional hernias: incidence following abdominal aortic aneurysm repair. J Cardiovasc Surg (Torino) 1995;36:487–490.

31. Cahalane MJ, Shapiro ME, Silen W: Abdominal incision: decision or indecision? Lancet 1989;1:146–148

32. Donaldson DR, Hall TJ, Zoltowski JA, Guillou PJ, Brennan TG: Does the type of suture material contribute to the strength of the lateral paramedian incision? Br J Surg 1982;69:163–165.

33. Ali J, Khan TA: The comparative effects of muscle transection and median upper abdominal incisions on postoperative pulmonary function. Surg Gynecol Obstet 1979;148:863–866.

34. Donati D, Brown SR, Eu KW, Ho YH, Seow-Choen F: Comparison between midline incision and limited right skin crease incision for right-sided colonic cancers. Tech Coloproctol 2002; 6:1–4.

35. Stone HH, Hoefling SJ, Strom PR, Dunlop WE, Fabian TC: Abdominal incisions: transverse vs vertical placement and continuous vs interrupted closure. South Med J 1983;76:1106–1108.

36. Lewis RT, Allan CM, Goodall RG, Marien B, Park M, Lloyd-Smith W, Wiegand FM: The conduct of cholecystectomy: incision, drainage, bacteriology and postoperative complications. Can J Surg 1982;25:304–307.

37. Douzdjian V, Gugliuzza KK: The impact of midline versus transverse incisions on wound complications and outcome in simultaneous pancreas-kidney transplants: a retrospective analysis. Transpl Int 1996;9:62–67.

38. Luijendijk RW, Jeekel J, Storm RK, Schutte PJ, Hop WC, Drogendijk AC, Huikeshoven FJ: The low transverse Pfannenstiel incision and the prevalence of incisional hernia and nerve entrapment. Ann Surg 1997;225:365–369.

39. Douketis JD, Berger PB, Dunn AS, et al: The perioperative management of antithrombotic therapy: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines (8th Edition). *Chest* 2008; 133:299S-339S.

40. Diaz Jr JJ, Conquest AM, Ferzoco SJ, et al: Multi-institutional experience using human acellular dermal matrix for ventral hernia repair in a compromised surgical field. *Arch Surg* 2009; 144:209-215.

41. Heller L, Levin SL, Butler CE: Management of abdominal wound dehiscence using vacuum- assisted closure in patients with compromised healing. *Am J Surg* 2006; 191:165-172.

42. Mangram AJ, Horan TC, Pearson ML, et al: Guideline for prevention of surgical site infection, 1999. Hospital Infection Control Practices Advisory Committee. *Infect Control Hosp Epidemiol* 1999; 20:250-278.

43. Awad SS, Elhabash SI, Lee L, et al: Increasing incidence of methicillin-resistant Staphylococcus aureus skin and soft-tissue infections: Reconsideration of empiric antimicrobial therapy. *Am J Surg* 2007; 194:606-610.

44. National Nosocomial Infections Surveillance (NNIS) : System Report, Data Summary from January 1992–June 2001, issued August 2001. *Am J Infect Control* 2001; 29:404-421.

45. Culver DH, Horan TC, Gaynes RP, et al: Surgical wound infection rates by wound class, operative procedure, and patient risk index. National Nosocomial Infections Surveillance System. *Am J Med* 1991; 91:152S-157S.

46. Anderson DJ, Kaye KS, Classen D, et al: Strategies to prevent surgical site infections in acute care hospitals. *Infect Control Hosp Epidemiol* 2008; 29(Suppl 1):S51-S61.

47. Buggy DJ, Crossley AW: Thermoregulation, mild perioperative hypothermia and postanaesthetic shivering. *Br J Anaesth* 2000; 84:615-628.

48. Rosenberg H, Antognini JF, Muldoon S: Testing for malignant hyperthermia. *Anesthesiology* 2002; 96:232-237.

49. Jawa RS, Kulaylat MN, Baumann H, et al: What is new in cytokine research related to trauma/critical care?. *J Intensive Care Med* 2006; 21:63-85.

50. Bukhary ZA: Candiduria: A review of clinical significance and management. *Saudi J Kidney Dis Transpl* 2008; 19:350-360.

51. Centers for Medicare and Medicaid Services (CMS), HHS : Medicare program; changes to the hospital inpatient prospective payment systems and fiscal year 2008 rates. *Fed Regist* 2007; 72:47129-48175.

52. Edwards JR, Peterson KD, Andrus ML, et al: National Healthcare Safety Network (NHSN) Report, data summary for 2006, issued June 2007. *Am J Infect Control* 2007; 35:290-301.

53. Ksycki MF, Namias N: Nosocomial urinary tract infection. *Surg Clin North Am* 2009; 89:475-481.ix–x

54. American Thoracic Society; Infectious Diseases Society of America : Guidelines for the management of adults with hospital-acquired, ventilator-associated, and healthcare-associated pneumonia. *Am J Respir Crit Care Med* 2005; 171:388-416.

55. Practice guidelines for preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration: application to healthy patients undergoing elective procedures: A report by the American Society of Anesthesiologist Task Force on Preoperative Fasting. *Anesthesiology* 1999; 90:896-905.

56. Heit JA, Silverstein MD, Mohr DN, et al: Risk factors for deep vein thrombosis and pulmonary embolism: a population-based case-control study. *Arch Intern Med* 2000; 160:809-815.

57. Goldhaber SZ: Echocardiography in the management of pulmonary embolism. *Ann Intern Med* 2002; 136:691-700.

58. Geerts WH, Bergqvist D, Pineo GF, et al: Prevention of venous thromboembolism: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines (8th Edition). *Chest* 2008; 133:381S-453S.

59. Eagle KA, Berger PB, Calkins H, et al: ACC/AHA Guideline Update for Perioperative Cardiovascular Evaluation for Noncardiac Surgery—Executive Summary. A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Update the 1996 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery). *Anesth Analg* 2002; 94:1052-1064.

60. Anderson JL, Adams CD, Antman EM, et al: ACC/AHA 2007 guidelines for the management of patients with unstable angina/non-ST-Elevation myocardial infarction: A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the

2002 Guidelines for the Management of Patients With Unstable Angina/Non-ST-Elevation Myocardial Infarction) developed in collaboration with the American College of Emergency Physicians, the Society for Cardiovascular Angiography and Interventions, and the Society of Thoracic Surgeons endorsed by the American Association of Cardiovascular and Pulmonary Rehabilitation and the Society for Academic Emergency Medicine. *J Am Coll Cardiol* 2007; 50:e1-e157.

62. Almansaseer Y, Mukherjee D, Kline-Rogers EM, et al: Implementation of the ACC/AHA guidelines of preoperative cardiac risk assessment in a general medicine preoperative clinic improving efficiency and preserving outcomes. Cardiology 2005; 103:24-29

62. Polanczyk CA, Goldman L, Marcantonio ER,et al Supraventricular arrhythmia in patients having noncardiac surgery: clinical correlates and effect on length of stay. *Ann Intern Med* 1998; 129:279-285.

63. Hunt SA, Baker DW, Chin MH, et al: ACC/AHA guidelines for the evaluation and management of chronic heart failure in the adult: Executive summary.*J Heart Lung Transplant* 2002; 21:189-203.

64. Bonet S, Agusti A, Arnau JM, et al: Beta-adrenergic blocking agents in heart failure: benefits of vasodilating and non-vasodilating agents according to patients' characteristics: A meta-analysis of clinical trials. *Arch Intern Med* 2000; 160:621-627.

65. Moore AF, Hargest R, Martin M, et al: Intra-abdominal hypertension and the abdominal compartment syndrome. *Br J Surg* 2004; 91:1102-1110.

66. Karsou SA, Jaber BL, Pereira BJ: Impact of intermittent hemodialysis variables on clinical outcomes in acute renal failure. *Am J Kidney Dis* 2000; 35:980-991.

67. Cooper MS, Stewart PM: Corticosteroid insufficiency in acutely ill patients. *N Engl J Med* 2003; 348:727-734.

68. Migneco A, Ojetti V, Testa A, et al: Management of thyrotoxic crisis. *Eur Rev Med Pharmacol Sci* 2005; 9:69-74.

69. Postoperative Ileus Management Council : *Proceedings of Consensus Panel to Define Postoperative Ileus. Colorectal surgery consensus report*. Atlanta, Thomson American Health Consultants, 2006.

70. Schwarz NT, Kalff JC, Turler A, et al: Selective jejunal manipulation causes postoperative pan-enteric inflammation and dysmotility. *Gastroenterology* 2004; 126:159-169.

71. Kulaylat MN, Doerr RJ: *Small bowel Obstruction. In: Holzheimer RG,* Mannick JA, ed. *Surgical treatment—evidence-based and problem-oriented*, New York: Zuckschwerdt; 2001:102-113

72. Kirkpatrick AW, Balogh Z, Ball CG, et al: The secondary abdominal compartment syndrome: Iatrogenic or unavoidable?. *J Am Coll Surg* 2006; 202:668-679.

73. Simon TL, Alverson DC, AuBuchon J, et al: Practice parameter for the use of red blood cell transfusions: Developed by the Red Blood Cell Administration Practice Guideline Development Task Force of the College of American Pathologists. *Arch Pathol Lab Med* 1998; 122:130-138.

74. Seder CW, Villalba Jr MR, Robbins J, et al: Early colectomy may be associated with improved survival in fulminant Clostridium difficile colitis: An 8-year experience. *Am J Surg* 2009; 197:302-307.

75. Sailhamer EA, Carson K, Chang Y, et al: Fulminant Clostridium difficile colitis: Patterns of care and predictors of mortality. *Arch Surg* 2009; 144:433-439.discussion 439–440

76. Pepin J, Vo TT, Boutros M, et al: Risk factors for mortality following emergency colectomy for fulminant Clostridium difficile infection. *Dis Colon Rectum* 2009; 52:400-405.

77. Slim K, Vicaut E, Panis Y, et al: Meta-analysis of randomized clinical trials of colorectal surgery with or without mechanical bowel preparation. *Br J Surg* 2004; 91:1125-1130.

78. Uzunkoy A, Akinci OF, Coskun A, et al: Effects of antiadhesive agents on the healing of intestinal anastomosis. *Dis Colon Rectum* 2000; 43:370-375.

79. August DA, Serrano D, Poplin E: "Spontaneous," delayed colon and rectal anastomotic complications associated with bevacizumab therapy. *J Surg Oncol* 2008; 97:180-185.

80. Branagan G, Finnis D: Prognosis after anastomotic leakage in colorectal surgery. *Dis Colon Rectum* 2005; 48:1021-1026.

81. Stojadinovic A, Brooks A, Hoos A, et al: An evidence-based approach to the surgical management of resectable pancreatic adenocarcinoma. *J Am Coll Surg* 2003; 196:954-964.

82. Orgill DP, Manders EK, Sumpio BE, et al: The mechanisms of action of vacuum-assisted closure: More to learn. *Surgery* 2009; 146:40-51.

83. Teubner A, Morrison K, Ravishankar HR, et al: Fistuloclysis can successfully replace parenteral feeding in the nutritional support of patients with enterocutaneous fistula. *Br J Surg* 2004; 91:625-631.

84. Wainstein DE, Fernandez E, Gonzalez D, et al: Treatment of high-output enterocutaneous fistulas with a vacuum-compaction device. A ten-year experience. *World J Surg* 2008; 32:430-435.

85. Wind J, van Koperen PJ, Slors JF, et al: Single-stage closure of enterocutaneous fistula and stomas in the presence of large abdominal wall defects using the components separation technique. *Am J Surg* 2009; 197:24-29.

86. Lin HJ, Spoerke N, Deveney C, et al: Reconstruction of complex abdominal wall hernias using acellular human dermal matrix: A single institution experience. *Am J Surg* 2009; 197:599-603.

87. Alghamdi A, Jawas A, Hart R: Use of octreotide for the prevention of pancreatic fistula after elective pancreatic surgery: a systematic review and meta-analysis. *Canadian J Surg* 2007; 50(6):459-466.

88. Krahenbuhl L, Sclabas G, Wente MN, et al: Incidence, risk factors, and prevention of biliary tract injuries during laparoscopic cholecystectomy in Switzerland. *World J Surg* 2001; 25:1325-1330.

89. Burkitt G, Quick C, Gatt D. *Essential surgery*, 2nd edn. Oxford: Churchill Livingstone, 1995.

90. Cuschieri A, Grace PA. *Clinical surgery*. Oxford: Blackwell, 2003.

91. Gan TJ, Meyer TA, Apfel CC *et al*. Society for Ambulatory Anesthesia guidelines for the management of postoperative nausea and vomiting.

92. *Anesth Analg* 2007; **105**: 1615–28.

93 Grace PA, Borley N. *Surgery at a glance*. Oxford: Blackwell, 2006.

94. Intensive Care Society website. Levels of critical care for adult patients. Available from: www.ics.ac.uk/ intensive_ care_ professional/ standards_ and_ guidelines/ levels_ of _ critical_ care _for _adult _patients.

95. Sachs SM, Morton JH, Schwartz SI. Acute mesenteric ischemia. *Surgery*. Oct 1982;92(4):646-53.

96. Cooper A, Barlow B, DiScala C, String D. Mortality and truncal injury: the pediatric perspective. *J Pediatr Surg*. Jan 1994;29(1):33-8.

PROFORMA

Name : Hospital No :

Age : Case No :

Sex : Occupation :

Complaints :

H/o present illness:

Past illness :

ASSOCIATED RISK FACTORS;

HT, DM,CAHD, Copd, Smoker, Alcoholic, Previous Surgery

Nature of emergency laparotomy done :

Complication presenting with :

Predisposing Pre operative factors :

Predisposing Per operative factors :

Predisposing Post operative factors :

General examination :

Build and nourishment :

Height and weight :

Systemic examination :

CVS :

RS :

CNS :

PR :

BP :

ABDOMEN:

INVESTIGATIONS

Hemoglobin	DC	TC	P	L	E
Blood Sugar	BT	CT			

Blood Urea

Serum Creatinine

Serum Electrolytes

Na+	Cl-
K+	Hco3-

Sr Albumin

Sr globulin

VCTC

CXR

X ray Abdomen

USG Abdomen

CT Abdomen

Pus culture and sensitivity

DIAGNOSIS :

PROCEDURE DONE :

WOUND CLASSIFICATION :

DURATION OF SURGERY :

DURATION OF STAY :

POST OPERATIVE COMPLICATIONS :

Bleeding :

Hematoma :

Fever :

SSI :

Dehiscence :

Burst abdomen :

DVT :

Sub diaphragmatic abscess :

Stich abscess :

Fistula :

Incisional hernia :

RS :

CVS :

CNS :

Renal :

Management of complications :

RESULT

INFORMED CONSENT FORM

(This is only a guideline – Relevant changes to be made as per the study requirements)

Title of the study: "_____"_

Name of the participant:_____

Name of the Principal (Co-investigator): _____

Name of the Institution:_____

Name and address of the sponsor/agency (ies) (if any): _____

_____

Documentation of the informed consent.

I _____have read the information in this form (or it has been read to me). I was free to ask any questions and they have been answered. I am over 18 years of age and , exercising my free power of choice, hereby give my consent to be included as a participant

i_____

_____"(title of the study).

1. I have read and understood this consent form and the information provided to me .

2. I have had the consent document explained to me.

3. I have been explained about the nature of the study.

4. I have been explained about my rights and responsibilities by the investigator.

5. I have been informed the investigator of all the treatments I am taking or have taken in the past _____ months including any native (alternative) treatment.

6. I have been advised about the risks associated with my participation in this study*

7. I agree to cooperate with the investigator and I will inform him / her immediately if I suffer unusual symptoms.*

8. I have not participated in any research study within the past _____ months.*

9. I have not donated blood within the past_____ months – Add if the study involves extensive blood sampling.*

10. In am aware of the fact that I can opt out of the study at any time without having to give any reason and this will not affect my future treatment in this hospital .*

11. I am also aware that the investigator may terminate my participation in the study at any time for any reason, without my consent.*

12. I hereby give permission to the investigators to release the information obtained from me as result of participation in this study to the sponsors, regulatory authorities, Govt. Agencies, and IEC. I understand that they are publicly presented.

13. In have understand that my identity will be kept confidential if my data are publicly presented.

14. In have had my questions answered to my satisfaction.

15. I have decided to be in the research study.

I am aware that if I have any question during this study, I should contact the investigator. By signing this consent form I attest that the information given in this document has been clearly explained to me and understood by me , I will be given a copy of this consent document.

For adult participants:

Name and signature/thumb impression of the participant (or legal representative if participant incompetent)

Name _____ Signature _____Date _____ Name and Signature of impartial witness (required for illiterate patients).

Name_____Signature _____ Date _____ Address and contact number of the impartial witness:

_____

Name and Signature of the investigator or his representative obtaining consent:

Name _____Signature _____ _____ Date _____

Points 6,7,8,9,10,11 of consent document may be excluded in such cases.

MASTER CHART

ABBREVATIONS FOR MASTER CHART

#RIB	Fracture Rib
AB	Aperistaltic Bowel
ADL	Adhesiolysis
AFL	Air Fluid Level
ALB	Albumin
APD	Appendicectomy
AUD	Air Under Diaphragm
BA	Burst Abdomen
BBA	Bird Peak Appearance
BLE	Bleeding
BLR	Bladder Rupture
BP	Blood Pressure
BPR	Biopsy/Patch Repair
CC	Clean Contaminated
CG	Cecal Growth
CLE	Clean
COM	Complicated
CON	Contaminated
CON	Conservative
COP	Closure of Perforation
COPD	Chronic Obstructive Pulmonary Disease
CRE	Creatinine
CT	Computed Tomography Abdomen
CUR	Cured
CXR	Chest Xray
DBL	Dilated Bowel Loops

DEH	Dehiscence
DEL	Delirium
DIA	Diagnosis
DIR	Dirty
DIV	Diverticulitis
DM	Diabetes Mellitus
DRA	Drainage
DUP	Duodenal Perforation
E	Eosinophils
E.C	E.Coli
ERD	Elevated Right Diaphragm
EXP	Exploration
FF	Free Fluid
FIS	Fistula
GAP	Gastric Perforation
GG	Ground Glass
GLO	Globulin
Hb%	Hemoglobin
HEM	Hematoma
HER	Hernia
HP	Hemoperitoneum
HT	Hyper Tension
I O	Intestinal Obstruction
ILE	Ileus
IP	In patient
IP	Ileal Perforation
JL	Jejunal Laceration
KLE	Klebseilla

L	Lymphocytes
LAP	Laparotomy
LAR	Liver Abscess Rupture
LL	Liver Laceration
M	Monocytes
MAN	Management
MEI	Mesentric Ischemia
MESH	Mesh Repair
OBH	Obstructed Hernia
OH	Alcoholic
OPR	Omental Patch Repair
ORG	Organisms
P	Polymorphs
PA	Perforated appendicitis
PJD	Perforated Jejunal Diverticulum
POP	Post Operative Period
PR	Pulse Rate
PS	Previous Surgery
Re Lap	Re Laparotomy
REN	Renal
RES	Resection
SDA	Sub Diaphragmatic Abscess
SG	Sigmoid Growth
SL	Splenic Laceration
SMO	Smoker
SPL	Splenectomy
SSI	Surgical Site Infection

STI	Stich abscess
SUG	Sugar
TC	Total Count
Temp	Temperature
TRC	Transverse Colostomy
URE	Urea
USG	Ultra Sono Gram
WC	Wound Classification
XAE	X Ray Abdomen Erect
BLR	Bladder Repair
ANR	Anatomy Repair

ABBREVATIONS

ALI	Acute lung injury
ARDS	Acute respiratory distress syndrome
ASA	American society of anesthesia
BMI	Body mass index
CABG	Coronary artery bypass surgery
CAD	Coronary artery disease
CNS	Central nervous system
COPD	Chronic obstructive pulmonary disease
CREA	Creatinine
CT	Computed tomography
CVP	Central venous pressure
CVS	Cardio vascular system
CXR	Chest x-ray
DC	Differential count
DM	Diabetes
DVT	Deep vein treatment
E	Eosinophills
ETT	Endotracheal intubation
FEV1	Forced expiratory volume in one second
FIO2	Fraction of inspired oxygen
GIT	Gastro intestinal tract
Hb%	Hemoglobin
HT	Hypertension
INT OBST	Intestinal obstruction
L	Lympocytes
LMWH	Low molecular weigh heparin

M	Monocytes
MRSA	Methicillin resistant staphylococcus aures
N	Not present
NAD	No abnormality detected
ND	Not done
P	Polymorphs
PaCO2	Partial pressure of co2
Pao2	Partial pressure of o2
POD	Post operative delirium
PPI	Proton pump inhibitors
PRO AB	Prophylactic antibiotics
RS	Respiratory system
SPP	Species
SSG	Split skin graft
SSI	Surgical site infection
SUG	Sugar
TC	Total count
TnI	Troponin i
TnT	Troponin t
UA	Unstable angina
UFH	Unfractionated heparin
USG	Ultra sono gram
VISA	Vancomycin intermediate resistant staphylococcus aureus
VRSA	Vancomycin resistant staphylococcus aureus
VUS	Venous ultrasound
Y	Present
PREV SUR	Previous surgery